(19)日本国特許庁（ＪＰ）　(12)公開特許公報（Ａ）　(11)特許出願公開番号

特開平6－300541

(43)公開日　平成６年(1994)10月28日

(51)Int.Cl.[5]	識別記号	庁内整理番号	ＦＩ	技術表示箇所
Ｇ０１Ｂ　11/24		Ｃ　9108－2Ｆ		
Ｇ０１Ｎ　21/88		Ｆ　8304－2Ｊ		

審査請求　未請求　発明の数17　ＯＬ　（全 37 頁）

(21)出願番号　特願平6－22889

(22)出願日　平成６年(1994)２月21日

(31)優先権主張番号　特願平5－31491

(32)優先日　平５(1993)２月22日

(33)優先権主張国　日本（ＪＰ）

(71)出願人　000237570
富士通オートメーション株式会社
神奈川県川崎市中原区上小田中1015番地

(72)発明者　加藤　修
神奈川県川崎市中原区上小田中1015番地
富士通オートメーション株式会社内

(72)発明者　本村　敏克
神奈川県川崎市中原区上小田中1015番地
富士通オートメーション株式会社内

(72)発明者　斉藤　肇
神奈川県川崎市中原区上小田中1015番地
富士通株式会社内

(74)代理人　弁理士　北野　好人

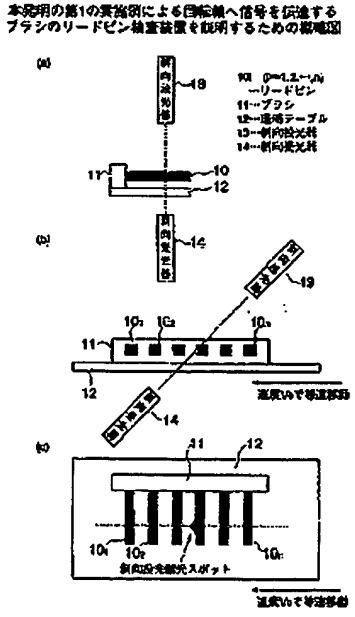
最終頁に続く

(54)【発明の名称】　リードピン検査装置及び位置制御装置

(57)【要約】

【目的】本発明は、リードピンの位置ずれ、高さずれ、消失、集団的傾斜等の欠陥を高速、高精度、低価格で、安定的に検査するリードピン検査装置、及び対面する２つの面の相対的位置を高速、高精度、低価格で、安定的に制御する位置制御装置を提供することを目的とする。

【構成】複数のリードピン１０ｉ（ｉ＝１，２，…，ｎ）が引き出されているブラシ１１を等速駆動機によってリードピン１０ｉの整列方向に速度Ｖｏで等速度移動させつつ、斜向投光器１３によってリードピン１０ｉの先端部をその整列面に対して所定の角度φをもって照射し、リードピン１０ｉの間を通過したスポット光を斜向受光器１４によって受光し、斜向受光器１４の出力信号のオン／オフ時刻Ｔｉ等に基づき演算することにより、リードピンの高さずれ量ΔＺ等を計測し、リードピンの欠陥の有無を判別する。



1

【特許請求の範囲】

【請求項１】　所定の間隔をおいて整列された複数のリードピンを検査するリードピン検査装置において．

複数のリードピンをもつ被検査物を搭載するステージと．

前記複数のリードピンの整列面に所定の角度をもってスポット光を照射する投光器及び前記複数のリードピンの間を通過した前記投光器からのスポット光を受光する受光器からなる投受光器と．

前記投受光器又は前記ステージを前記複数のリードピンの整列方向に移動させる駆動手段と．

前記駆動手段による前記投受光器と前記ステージとの相対的な移動速度を検出する相対速度検出手段と．

前記受光器の入光状態から遮光状態への移行時刻又は遮光状態から入光状態への移行時刻を検出する時刻検出手段と．

前記相対速度検出手段からの速度信号及び前記時刻検出手段によって検出された移行時刻に基づき、各リードピンの正常な位置からの変位量又はリードピンの欠損数を計測する演算手段と、

前記演算手段によって計測された各リードピンの変位量又はリードピンの欠損数に基づき、前記複数のリードピンにおける欠陥の有無を判定する欠陥判定手段とを有することを特徴とするリードピン検査装置。

【請求項２】　請求項１記載のリードピン検査装置において．

前記駆動手段及び前記相対速度検出手段に代えて．前記投受光器又は前記ステージを前記複数のリードピンの整列方向に等速移動させる等速駆動手段を有し、

前記演算手段が．前記時刻検出手段によって検出された移行時刻に基づき、各リードピンの正常な位置からの変位量又はリードピンの欠損数を計測することを特徴とするリードピン検査装置。

【請求項３】　請求項１記載のリードピン検査装置において．

前記相対速度検出手段に代えて、前記複数のリードピンのうちの所定の基準位置から前記投光器がスポット光を照射する検査対象ピンまでの距離を検出する距離検出手段を有し、

前記演算手段が．前記距離検出手段からの距離信号及び前記時刻検出手段によって検出された移行時刻に基づき．各リードピンの正常な位置からの変位量又はリードピンの欠損数を計測することを特徴とするリードピン検査装置。

【請求項４】　請求項１乃至３のいずれかに記載のリードピン検査装置において．

前記演算手段によって計測された各リードピンの変位量又はリードピンの欠損数を記憶する計測量記憶手段を有することを特徴とするリードピン検査装置。

【請求項５】　請求項１乃至４のいずれかに記載のリードピン検査装置において．

2

前記投光器が．前記複数のリードピンの先端部を前記複数のリードピンの整列面に対して斜めに照射するように設置されており．

前記複数のリードピンにおける各リードピンの位置ずれ量及び消失ピン数又は各リードピンの高さずれ量及び消失ピン数を計測することを特徴とするリードピン検査装置。

【請求項６】　請求項１乃至４のいずれかに記載のリードピン検査装置において．

前記投光器が．前記複数のリードピンの根元部を前記複数のリードピンの整列面に対してほぼ垂直に照射するように設置されており、

前記複数のリードピンにおける消失ピン数を計測することを特徴とするリードピン検査装置。

【請求項７】　請求項１乃至４のいずれかに記載のリードピン検査装置において．

前記投受光器が．前記複数のリードピンの先端部を前記複数のリードピンの整列面に対してほぼ垂直に照射する前記第１の投受光器と、前記複数のリードピンの先端部を前記複数のリードピンの整列面に対して斜めに照射する第２の投受光器とを有し．

前記複数のリードピンにおける各リードピンの位置ずれ量及び高さずれ量を計測することを特徴とするリードピン検査装置。

【請求項８】　請求項１乃至４のいずれかに記載のリードピン検査装置において．

前記投受光器が．前記複数のリードピンの先端部を前記複数のリードピンの整列面に対してほぼ垂直に照射する前記第１の投受光器と、前記複数のリードピンの根元部を前記複数のリードピンの整列面に対してほぼ垂直に照射する第２の投受光器とを有し、

前記複数のリードピンが集合的に整列方向へ傾斜している傾斜量を計測することを特徴とするリードピン検査装置。

【請求項９】　請求項１乃至４のいずれかに記載のリードピン検査装置において．

前記投受光器が．前記複数のリードピンの整列面に光を照射する投光器と、

前記投光器から発する光を集光し、所定の位置に所定の大きさのスポット光を照射する光学系と、

前記スポット光の外径近傍に配置され．前記投光器から発せられ、前記複数のリードピンの整列面に対して異なる角度で照射する光を受光する複数の受光器とを有することを特徴とするリードピン検査装置

【請求項１０】　請求項９記載のリードピン検査装置において、

前記複数の受光器の前面に光を伝達する線状の部材をそれぞれ設けたことを特徴とするリードピン検査装置。

【請求項１１】　請求項９記載のリードピン検査装置に

おいて、
前記受光器の前面に、前記投光器からの光を透過する微細な孔が形成されたマスクを設けたことを特徴とするリードピン検査装置
【請求項12】　請求項10記載のリードピン検査装置において、
前記光を伝達する線状の部材の前面に、前記投光器からの光を透過する微細な孔が形成されたマスクを設けたことを特徴とするリードピン検査装置
【請求項13】　請求項9乃至12のいずれかに記載のリードピン検査装置において、
前記スポット光のほぼ中心で直角に交差する直線上であって、前記投光器から発した光の強さがほぼ等しい位置に前記複数の受光器を配置したことを特徴とするリードピン検査装置
【請求項14】　対面する第1の面と第2の面との相対的位置を制御する位置制御装置において、
前記第1の面に固定された投光器と、
前記第2の面に設置され、前記第1の面と前記第2の面とが所定の相対的位置になるときに光軸が一致するように固定された受光器と、
前記第1の面又は前記第2の面の位置を変化させる駆動手段とを有し、
前記駆動手段によって前記第1及び第2の面の相対的位置を変化させ、前記投光器と前記受光器との光軸を一致させることにより、前記第1の面と前記第2の面とを所定の相対的位置に制御することを特徴とする位置制御装置。
【請求項15】　請求項14記載の位置制御装置において、
前記駆動手段が、前記第1及び第2の面の間隔を変化させるように前記第1の面又は前記第2の面を一定の方向に移動させる駆動手段であり、
前記駆動手段によって前記第1及び第2の面との相対的位置を変化させ、前記投光器と前記受光器との光軸を一致させることにより、前記第1の面の所定の点と前記第2の面の所定の点との距離を所定の距離に制御することを特徴とする位置制御装置。
【請求項16】　請求項15記載の位置制御装置において、
前記第1の面と前記第2の面とが平行に対面する2つの面であり、
前記駆動手段によって前記第1及び第2の面との相対的位置を変化させ、前記投光器と前記受光器との光軸を一致させることにより、前記第1の面と前記第2の面との距離を所定の距離に制御することを特徴とする位置制御装置。
【請求項17】　請求項14記載の位置制御装置において、
前記投光器が、異なる方向に光軸をもつ少なくとも3個

の投光器からなり、
前記受光器が、前記少なくとも3個の投光器に対応する少なくとも3個の受光器からなり、
前記駆動手段が、前記第1の面と前記第2の面とのなす距離及び角度を変化させる駆動手段であり、
前記駆動手段によって前記第1及び第2の面との相対的位置を変化させ、前記少なくとも3個の投光器と前記少なくとも3個の受光器との光軸をそれぞれ一致させることにより、前記第1の面と前記第2の面とのなす距離及び角度を所定の距離及び角度に制御することを特徴とする位置制御装置。
【発明の詳細な説明】
【0001】
【産業上の利用分野】本発明は、リードピン検査装置及び位置制御装置に係り、特に側面から引き出された複数のリードピンをもつ部品、例えば回転体に信号を伝達するブラシやICパッケージ等のリードピンの位置ずれ、高さずれ、消失、集合的な傾斜等の欠陥の有無を判別するリードピン検査装置、及び顕微鏡等の光学系の自動フォーカスや部材の高精度な配置等に利用される位置制御装置に関する。
【0002】
【従来の技術】CCDカメラを使用する従来のICパッケージのリードピン検査方法を、図29を用いて説明する。ここで、図29（a）、（b）はICパッケージを側面及び上面から見たときのCCDカメラの配置を示す概略図、図29（c）はICパッケージのリードピンのCCDカメラによる取り込み画像を示す図である。
【0003】側面から複数のリードピン80i（i＝1、2、…、n）が引き出されているICパッケージ81の傍らに、CCDカメラ82を設置する。そしてこのリードピン80iの整列面に投光器（図示せず）から光をあて、CCDカメラ82によって撮像する。また、このCCDカメラ82は所定の表示装置（図示せず）に接続されており、この表示装置に表示された取り込み画像から、ICパッケージ81のリードピン80iの検査を行う。
【0004】例えばリードピン80i（i＝3）のように、複数のリードピン80iの整列方向へのずれ（以下、「位置ずれ」と呼ぶ）や、リードピン80i（i＝2）のように、その整列方向に垂直な方向へのずれ（以下、「高さずれ」と呼ぶ）を生じている場合、図29（c）に示す取り込み画像から、位置ずれ量ΔXや高さずれ量Δ2を求めることができる（「ICパッケージリードの検査技術」；雑誌「エレクトロ実装技術」、1992,5（vol.8 No.5）参照）。
【0005】また、変位センサを使用する従来のICパッケージのリードピン検査方法を、図30を用いて説明する。ここで、図30（a）はICパッケージを側面から見たときの変位センサの配置を示す概略図、図30

（ｂ）は変位センサの出力波形を示すグラフである。ＩＣパッケージ８１の側面から引き出されている複数のリードピン８０ｉの下方に、変位センサ８３を設置する。そしてＩＣパッケージ８１をリードピン８０ｉの整列方向に等速移動させつつ、その移動するリードピン８０ｉ先端部の下面に変位センサ８３からレーザ光を照射し、その反射光を再び変位センサ８３で検出し、その時間変化出力波形からＩＣパッケージ８１のリードピン８０ｉの検査を行う。

【０００６】例えばリードピン８０ｉ（ｉ＝２，３）のように位置ずれや高さずれを生じている場合、図３０（ｂ）に示すように、変位センサ８３の時間変化に対する出力波形において波形の高さや波形間の間隔に変化が生じる。従って、これらの高さの変位や間隔の変位から、リードピン８０ｉ（ｉ＝２，３）の高さずれや位置ずれを求めることができる（「ＩＣパッケージリードの検査技術」；雑誌「エレクトロ実装技術」、1992,5（vol.8 No.5）参照）。

【０００７】また、発光器及び受光器を使用する従来のＩＣパッケージのリードピン検査方法を、図３１を用いて説明する。ここで、図３１（ａ）はＩＣパッケージを側面から見た場合のリードピン先端部と発光器及び受光器の配置を示す概略図、図３１（ｂ）はその平面概略図である。ＩＣパッケージ８１の側面から引き出されている複数のリードピン８０ｉの整列面に対し所定の角度をもって１組の発光器８４及び受光器８５を設置する。そして発光器８４から照射された厚み寸法Ｓ、幅寸法Ｔのレーザ光８６が複数のリードピン８０ｉの間を通過して受光器８５に受光される受光量を受光器８５の出力値として記憶する。次いで、この１組の発光器８４及び受光器８５を図中の実線で示した位置から一点鎖線で示す位置に移動させ、同様の動作を繰り返す。

【０００８】このようにして記憶した受光器８５の出力値を、リードピンに欠陥のない正常なＩＣパッケージの場合と比較することにより、ＩＣパッケージ８１のリードピン８０ｉの検査を行う。例えばあるリードピンが位置ずれや高さずれを生じている場合、受光器８５の出力値が正常なＩＣパッケージの場合に得られる出力値と異なるため、リードピンの高さずれや位置ずれの有無を判定することができる（特開平１－２６０３４９号参照）。

【０００９】更に、レーザ測長器を使用する従来の位置制御方法を、図３２を用いて説明する。ここで、図３２は対面する２つの面の側面図である。平行に対面する２つの面の相対的位置を制御する場合、一方のＡ面にレーザ測長器８７を固定し、他方のＢ面に反射ミラー８８を固定する。そしてＡ面又はＢ面を垂直方向に移動しつつ、レーザ測長器８７から反射ミラー８８へレーザ光を発射すると共に、反射ミラー８８によって反射されたレーザ光の位相をレーザ測長器８７により検出する。そしてこの検出したレーザ光の位相の変化から、Ａ面とＢ面との距離を測定する。こうして、Ａ面及びＢ面を所定の距離をもつ位置に制御することができる。

【００１０】

【発明が解決しようとする課題】しかしながら、上記従来のＣＣＤカメラを使用するＩＣパッケージのリードピン検査方法においては、ＩＣパッケージ８１の１辺のリードピン８０ｉ全部をＣＣＤカメラ８２の視野内に収め、１回の撮像によって検査することは、ＣＣＤカメラ８２の分解能からして困難である。従って、一定以上の分解能を得るためには、ＩＣパッケージ８１又はＣＣＤカメラ８２を複数回移動させなければならず、検査時間が増大するという欠陥が生じる。尚、ＣＣＤカメラ８２を複数台設置することにより、検査時間の短縮を図ることが可能であるが、この場合は、検査装置の繁雑化とコストアップを招くという欠陥が生じる。

【００１１】また、上記従来の変位センサを使用するＩＣパッケージのリードピン検査方法においては、リードピン８０ｉ下面で反射させたレーザ光を変位センサ８３で検出するため、リードピン８０ｉ下面の表面状態の如何によっては反射光が変動し、安定して高さの変位や間隔の変位を検出することが困難になる場合が生じるという欠陥がある。

【００１２】また、ＩＣパッケージ８１のリードピン８０ｉの幅は、通常１００～２００μｍであるため、変位センサ８３の性能としては、１０μｍφ程度の微小レーザスポットを有し、かつ高速応答性を有することが要求される。従って、このような高性能な変位センサ８３でなければ検査精度の低下を招く一方、その検査精度を保証しようとすれば、コストアップを招くという問題が生じる。

【００１３】また、上記従来の発光器及び受光器を使用するＩＣパッケージのリードピン検査方法においては、複数のリードピン８０ｉの間を通過する光量全体を正常なＩＣパッケージの場合と比較するため、複数のリードピン８０ｉにおける高さずれや位置ずれの有無を判定することはできても、欠陥を有するリードピン８０自体の高さずれ量や位置ずれ量を計測することができない。従って、そのずれ量の大小判定に基づく検査が不可能であり、高精度の検査ができないという欠陥を有する。また、どのリードピン８０ｉにどのような欠陥が生じやすいか等の解析も不可能であり、その解析に基づいた取扱い方法や保管方法等の改善を図ることもできない。

【００１４】更に、上記従来のレーザ測長器を使用する位置制御方法においては、レーザ測長器８７が高価であるため、コストアップになるという欠陥がある。また、反射ミラー８８は、反射レーザ光が正確にレーザ測長器８７に入射するような向きに設置し、その表面をレーザ光波長λに対してλ／２～λ／４の精度の鏡面に保持しなければならないため、実際の使用においては、その設

置と管理に多大の手数を要するという問題もある。

【0015】そこで本発明は、このような従来技術の課題を解決し、リードピンの位置ずれ、高さずれ、消失、集団的傾斜等の欠陥を高速、高精度、低価格で、安定的に検査するリードピン検査装置、及び対面する2つの面の相対的位置を高速、高精度、低価格で、安定的に制御する位置制御装置を提供することを目的とする。

【0016】

【課題を解決するための手段】上記課題は、所定の間隔をおいて整列された複数のリードピンを検査するリードピン検査装置において、複数のリードピンをもつ被検査物を搭載するステージと、前記複数のリードピンの整列面に所定の角度をもってスポット光を照射する投光器及び前記複数のリードピンの間を通過した前記投光器からのスポット光を受光する受光器からなる投受光器と、前記投受光器又は前記ステージを前記複数のリードピンの整列方向に移動させる駆動手段と、前記駆動手段による前記投受光器と前記ステージとの相対的な移動速度を検出する相対速度検出手段と、前記受光器の入光状態から遮光状態への移行時刻又は遮光状態から入光状態への移行時刻を検出する時刻検出手段と、前記相対速度検出手段からの速度信号及び前記時刻検出手段によって検出された移行時刻に基づき、各リードピンの正常な位置からの変位量又はリードピンの欠損数を計測する演算手段と、前記演算手段によって計測された各リードピンの変位量又はリードピンの欠損数に基づき、前記複数のリードピンにおける欠陥の有無を判定する欠陥判定手段とを有することを特徴とするリードピン検査装置によって達成される。

【0017】また、上記のリードピン検査装置において、前記駆動手段及び前記相対速度検出手段に代えて、前記投受光器又は前記ステージを前記複数のリードピンの整列方向に等速移動させる等速駆動手段を有し、前記演算手段が、前記時刻検出手段によって検出された移行時刻に基づき、各リードピンの正常な位置からの変位量又はリードピンの欠損数を計測することを特徴とするリードピン検査装置によって達成される。

【0018】また、上記のリードピン検査装置において、前記相対速度検出手段に代えて、前記複数のリードピンのうちの所定の基準位置から前記投光器がスポット光を照射する検査対象ピンまでの距離を検出する距離検出手段を有し、前記演算手段が、前記距離検出手段からの距離信号及び前記時刻検出手段によって検出された移行時刻に基づき、各リードピンの正常な位置からの変位量又はリードピンの欠損数を計測することを特徴とするリードピン検査装置によって達成される。

【0019】また、上記のリードピン検査装置において、前記演算手段によって計測された各リードピンの変位量又はリードピンの欠損数を記憶する計測量記憶手段を有することを特徴とするリードピン検査装置によって達成される。また、上記のリードピン検査装置において、前記投光器が、前記複数のリードピンの先端部を前記複数のリードピンの整列面に対して斜めに照射するように設置されており、前記複数のリードピンにおける各リードピンの位置ずれ量及び消失ピン数又は各リードピンの高さずれ量及び消失ピン数を計測することを特徴とするリードピン検査装置によって達成される。

【0020】また、上記のリードピン検査装置において、前記投光器が、前記複数のリードピンの根元部を前記複数のリードピンの整列面に対してほぼ垂直に照射するように設置されており、前記複数のリードピンにおける消失ピン数を計測することを特徴とするリードピン検査装置によって達成される。また、上記のリードピン検査装置において、前記投受光器が、前記複数のリードピンの先端部を前記複数のリードピンの整列面に対してほぼ垂直に照射する前記第1の投受光器と、前記複数のリードピンの先端部を前記複数のリードピンの整列面に対して斜めに照射する第2の投受光器とを有し、前記複数のリードピンにおける各リードピンの位置ずれ量及び高さずれ量を計測することを特徴とするリードピン検査装置によって達成される。

【0021】また、上記のリードピン検査装置において、前記投光器が、前記複数のリードピンの先端部を前記複数のリードピンの整列面に対してほぼ垂直に照射する前記第1の投受光器と、前記複数のリードピンの根元部を前記複数のリードピンの整列面に対してほぼ垂直に照射する第2の投受光器とを有し、前記複数のリードピンが集合的に整列方向へ傾斜している傾斜量を計測することを特徴とするリードピン検査装置によって達成される。

【0022】また、上記のリードピン検査装置において、前記投受光器が、前記複数のリードピンの整列面に光を照射する投光器と、前記投光器から発する光を集光し、所定の位置に所定の大きさのスポット光を照射する光学系と、前記スポット光の外径近傍に配置され、前記投光器から発せられ、前記複数のリードピンの整列面に対して異なる角度で照射する光を受光する複数の受光器とを有することを特徴とするリードピン検査装置により達成される。

【0023】また、上記のリードピン検査装置において、前記複数の受光器の前面に光を伝達する線状の部材をそれぞれ設けたことを特徴とするリードピン検査装置により達成される。また、上記のリードピン検査装置において、前記受光器の前面に、前記投光器からの光を透過する微細な孔が形成されたマスクを設けたことを特徴とするリードピン検査装置により達成される。

【0024】また、上記のリードピン検査装置において、前記光を伝達する線状の部材の前面に、前記投光器からの光を透過する微細な孔が形成されたマスクを設けたことを特徴とするリードピン検査装置により達成され

る。また、上記のリードピン検査装置において、前記スポット光のほぼ中心で直角に交差する直線上であって、前記投光器から発した光の強さがほぼ等しい位置に前記複数の受光器を配置したことを特徴とするリードピン検査装置により達成される。

【0025】更に、対面する第1の面と第2の面との相対的位置を制御する位置制御装置において、前記第1の面に固定された投光器と、前記第2の面に設置され、前記第1の面と前記第2の面とが所定の相対的位置になるときに光軸が一致するように固定された受光器と、前記第1の面又は前記第2の面の位置を変化させる駆動手段とを有し、前記駆動手段によって前記第1及び第2の面の相対的位置を変化させ、前記投光器と前記受光器との光軸を一致させることにより、前記第1の面と前記第2の面とを所定の相対的位置に制御することを特徴とする位置制御装置によって達成される。

【0026】また、上記の位置制御装置において、前記駆動手段が、前記第1及び第2の面の間隔を変化させるように前記第1の面又は前記第2の面を一定の方向に移動させる駆動手段であり、前記駆動手段によって前記第1及び第2の面との相対的位置を変化させ、前記投光器と前記受光器との光軸を一致させることにより、前記第1の面の所定の点と前記第2の面の所定の点との距離を所定の距離に制御することを特徴とする位置制御装置によって達成される。

【0027】また、上記の位置制御装置において、前記第1の面と前記第2の面とが平行に対面する2つの面であり、前記駆動手段によって前記第1及び第2の面との相対的位置を変化させ、前記投光器と前記受光器との光軸を一致させることにより、前記第1の面と前記第2の面との距離を所定の距離に制御することを特徴とする位置制御装置によって達成される。

【0028】また、上記の位置制御装置において、前記投光器が、異なる方向に光軸をもつ少なくとも3個の投光器からなり、前記受光器が、前記少なくとも3個の投光器に対応する少なくとも3個の受光器からなり、前記駆動手段が、前記第1の面と前記第2の面とのなす距離及び角度を変化させる駆動手段であり、前記駆動手段によって前記第1及び第2の面との相対的位置を変化させ、前記少なくとも3個の投光器と前記少なくとも3個の受光器との光軸をそれぞれ一致させることにより、前記第1の面と前記第2の面とのなす距離及び角度を所定の距離及び角度に制御することを特徴とする位置制御装置によって達成される。

【0029】

【作用】本発明は、投受光器又は被検査物を搭載したステージを複数のリードピンの整列方向に移動させつつ、投受器によって複数のリードピンの整列面に所定の角度をもってスポット光を照射し、そのリードピンの間を通過したスポット光を受光器によって受光することにより、受光器の入光状態から遮光状態への移行時刻又は遮光状態から入光状態への移行時刻を検出することができる。

【0030】もし、複数のリードピンにおいて、あるリードピンが正常な位置からの変位していたり欠損していたりすると、受光器の入光状態から遮光状態への移行時刻又は遮光状態から入光状態への移行時刻が正常な場合の移行時刻と異なる。このため、その変化量を検出し、所定の演算を行うことにより、容易かつ正確に各リードピンの正常な位置からの変位量又はリードピンの欠損数を計測することができる。従って、これらの変位量又は欠損数に基づき、複数のリードピンにおける欠陥の有無を判定することが可能となる。

【0031】

【実施例】以下、本発明を図示する実施例に基づいて説明する。図1は本発明の第1の実施例による回転軸へ信号を伝達するブラシのリードピン検査装置を説明するための概略図であり、各図1（a）、（b）、（c）に検査対象たるブラシをそれぞれ正面、側面及び上面から見たときの1組の投受光器の配置を示す。また、図2は、受光器の出力信号を処理する回路構成を示すブロックダイアグラムである。

【0032】その側面から複数のリードピン10i（i＝1，2，…，n）が引き出されているブラシ11が、光を透過する透明テーブル12上に搭載されている。また、この透明テーブル12は、等速駆動機（図示せず）によってリードピン10iの整列方向に等速移動するようになっている。この透明テーブル12の上方には、例えば半導体レーザを用いた照射する斜向投光器13が設置され、リードピン10iの整列面に対して所定の角度φをもってスポット光を照射するようになっている。また、透明テーブル12の下方には、斜向投光器13に対向して、例えばpinフォトダイオードを用いた斜向受光器14が設置されており、リードピン10iの間を通過した斜向投光器13からのスポット光を受光するようになっている。こうしてリードピン10iの整列面を間に挟む1組の投受光器が配置されている。

【0033】また、この斜向受光器14には、斜向投光器13からのスポット光がリードピン10iの間を通過して入光している状態（入光状態）からスポット光がリードピン10iによって遮光されている状態（遮光状態）へ移行する時刻及び遮光状態から入光状態へ移行する時刻、即ち斜向受光器14の出力信号のオン／オフ時刻Ti（i＝1，2，…，n）及びオフ／オン時刻T′i（i＝1，2，…，n）を検出する時刻検出回路15が接続されている。

【0034】また、この時刻検出回路15には、リードピン10iの数をカウントするピン数カウンタ16、オン／オフ時刻Tiをカウントするオン／オフ時刻カウンタ17、及びオフ／オン時刻T′iをカウントするオフ

／オン時刻カウンタ１８がそれぞれ接続されている。また．ピン数カウンタ１６及びオン／オフ時刻カウンタ１７には、高さずれ量△Ｚを演算する高さずれ量演算回路１９が接続され．オン／オフ時刻カウンタ１７及びオフ／オン時刻カウンタ１８には、リードピンの消失ピン数ｍを演算する消失ピン数演算回路２０が接続されている。

【００３５】更に、ピン数カウンタ１６、高さずれ量演算回路１９、及び消失ピン数演算回路２０は、計測量記憶回路２１に接続されると共に、これら高さずれ量演算回路１９及び消失ピン数演算回路２０は、リードピンの欠陥の有無を最終的に判別する欠陥判定回路２２に接続されている。次に、第１の実施例によるリードピン検査装置を用いてリードピンの高さずれ量△Ｚを計測する場合を．図２のブロックダイアグラム及び図３に示す受光器の出力信号のタイムチャートを用いて説明する。

【００３６】いま、図３に示すように．検査対象たるブランの各リードピン１０ｉの幅をＷ．その厚さをＨ、正＊

$$\pi/2 > \phi > \tan^{-1}\{(H+2\cdot\Delta Z_{MAX})/L\} \quad \cdots(1)$$

を満足するように設定する必要がある。照射角φがπ／２になると、斜向投光器１３から垂直に照射されることになり、高さずれ量△Ｚを計測することができなくなるからであり、また照射角φが上記（１）式の範囲より小さくなると、スポット光がリードピン１０ｉの間を通過できなくなる場合が生じるからである。但し、高さずれ量△Ｚを計測する場合には．上記（１）式の範囲内でできるだけ小さい方が、即ちスポット光が斜めから照射する方が望ましい。

【００３８】こうして、斜向投光器１３からのスポット光がリードピン１０ｉの先端部を照射する一方．リードピン１０ｉの間を通過したスポット光は、斜向受光器１４によって受光される。そしてスポット光の斜向受光器１４への入光状態からリードピン１０ｉの左上角（図３（ａ）中に●で示す）により遮光状態へ移行する時刻、※

$$T_j = \{(W+L)\times(j-1)+\Delta Z_j/\tan\phi\}/V_0 + T_1 \quad \cdots(2)$$

となり、従ってｊ番目のリードピン１０ｉの高さずれ量★　★△Ｚｊは、

$$\Delta Z_j = \{(T_j - T_1)\times V_0 - (W+L)\times(j-1)\}\times\tan\phi \quad \cdots(3)$$

となる。

【００４０】次に、第１の実施例によるリードピン検査装置を用いてリードピンの消失ピン数ｍを計測する場合を．図２のブロックダイアグラム及び図４に示す受光器の出力信号のタイムチャートを用いて説明する。いま、図４に示すように、ｊ番目のリードピン１０ｉの次からｍ個のリードピンが消失しているとする。

【００４１】高さずれ量△Ｚを計測した場合と同様にして．検査対象たるブラシ１１を透明テーブル１２上に搭載し．等速駆動機によってリードピン１０ｉの整列方向に等速度Ｖｏで移動させつつ、斜向投光器１３からスポット光を照射する。そしてリードピン１０ｉの間を通過＊宮に整列された間隔をＬとする。また．ｊ番目のリードピン１０ｉが複数のリードピン１０ｉの整列面に垂直な方向に下向きに△Ｚｉだけずれているとする。但し、リードピン１０ｉの整列方向への位置ずれはないものとする。

【００３７】まず、ブラシ１１を透明テーブル１２上に搭載した後、この透明テーブル１２を等速駆動機（図示せず）によって複数のリードピン１０ｉの整列方向に等速度Ｖｏで移動させる。そして同時に．斜向投光器１３からスポット光を照射する．このとき．斜向投光器１３からのスポット光は、リードピン１０ｉの先端部を照射することが望ましい。先端部の方が高さずれ量△Ｚが大きくなるため．計測が容易かつ正確になるからである。また．斜向投光器１３からのスポット光がリードピン１０ｉの整列面に対してなす角度、いわゆる照射角φは、リードピン１０ｉの整列面からの高さ方向への最大ずれ量をΔZ_{MAX}とすると、

※即ち出力信号のオン／オフ時刻Ｔ１（図３（ｂ）中に●で示す）及び遮光状態からリードピン１０１の右下角（図３（ａ）中に○で示す）により入光状態へ移行する時刻．即ち出力信号のオン／オフ時刻Ｔ′１（図３（ｂ）中に○で示す）を．時刻検出回路１５によって検出し．ｊ番目のリードピン１０ｉによるオン／オフ時刻Ｔｊをオン／オフ時刻カウンタ１７によってカウントする。

【００３９】次いで、高さずれ量演算回路１９において．ピン数カウンタ１６からの対象とするリードピンの数ｊ及びオン／オフ時刻カウンタ１７からのオン／オフ時刻Ｔｉに基づき、高さずれ量△Ｚｊを演算する。即ち．ｊ番目のリードピン１０ｉによるオン／オフ時刻Ｔｉは．

★★したスポット光を斜向受光器１４によって受光し．斜向受光器１４の出力信号のオン／オフ時刻Ｔ１及びオフ／オン時刻Ｔ′ｉを、時刻検出回路１５によって検出する。

【００４２】次いで、時刻検出回路１５によって検出したｊ番目のリードピン１０１のオフ／オン時刻Ｔ′ｉをオフ／オン時刻カウンタ１８によってカウントすると共に．リードピン１０ｉの次のリードピン１０ｋによるオン／オフ時刻Ｔｋをオン／オフ時刻カウンタ１７によってカウントする。次いで．消失ピン数演算回路２０において．オフ／オン時刻カウンタ１８及びオン／オフ時刻カウンタ１７からのオフ／オン時刻Ｔ′ｉ及びオン／オ

フ時刻Tkに基づき、消失ピン数mを計測する。

【0043】即ち、m個の消失ピンが存在すると、j番目のリードピン10jのオフ／オン時刻T′jから次の＊

$$\Delta T = Tk - T'j = \{(W+L)\times m + L\}/Vo \quad \cdots(4)$$

となる。従って消失ピン数mは、

$$m = (\Delta T \times Vo - L)/(W+L) = \{(Tk - T'j)\times Vo - L)\}/(W+L) \quad \cdots(5)$$

となる。

【0044】以上のようにして計測したリードピンの高さずれ量Δ2i及び消失ピン数mは、データとして計測量記憶回路21に記憶されると共に、欠陥判定回路22において、これらの計数量に基づくリードピンの欠陥についての最終的な判別がなされる。このように第1の実施例によれば、回転軸へ信号を伝達するブラシ11を等速駆動機によってリードピン10iの整列方向に速度Voで等速度移動させつつ、斜向投光器13によってリードピン10iの先端部をその整列面に対して所定の鋭角度φをもって照射し、リードピン10iの間を通過したスポット光を斜向受光器14によって受光し、斜向受光器14の出力信号のオン／オフ時刻Ti及びオフ／オン時刻T′iを時刻検出回路15によってそれぞれ検出し、高さずれ量演算回路19及び消失ピン数演算回路20において（3）、（5）式に基づき演算することにより、リードピンの高さずれ量Δ2及び消失ピン数mを計測することができる。従って、欠陥判定回路22により、これらのリードピンの高さずれ量Δ2i及び消失ピン数mに基づいて、対象となるリードピンが欠陥であるか否かを判定し、複数のリードピン10iにおけるリードピンの欠陥の有無を最終的に判別することができる。

【0045】このとき、リードピンの高さずれ量Δ2i及び消失ピン数mは、斜向受光器14の出力信号のオン／オフ時刻Ti及びオフ／オン時刻T′iに基づく特徴量のみで計測することができるため、検査のためのブラシ11の搬送移動の後、短時間で高速に判定結果を得ることが可能である。また、これらのリードピンの高さずれ量Δ2i及び消失ピン数mの計数量は、データとして計測量記憶回路21に記憶されるため、製造プロセスや取扱方法等を改善するための分析に供することが可能となる。

【0046】また、斜向投光器13及び斜向受光器14には、例えば半導体レーザ及びpinフォトダイオード等の比較的安価なものを用いることが可能であるため、コスト的にも低価格化を実現することができる。また、斜向投光器13及び斜向受光器14からなる投受光器は透過型の光学系であるため、リードピン10iの表面状態に依存することなく、斜向受光器14からの安定した出力信号を得ることができる。従って、リードピン10iの変位量や欠損量について高精度の計測が可能となり、リードピンの欠陥についての最終的な判別も信頼性の高いものとなる。

＊リードピン10kによるオン／オフ時刻Tkまでの斜向受光器14への入光時間ΔTが長くなり、

【0047】また、例えば半導体レーザに所定のレンズ系を付設して斜向投光器13のスポット光をより微小に絞り、かつ斜向受光器14の出力信号を更に高速度にサンプリングすることにより、更に高い分解能で高速度の計測が可能となり、従って検査における高精度化、高速度化を向上させることが可能となる。尚、上記第1の実施例においては、等速駆動機によってブラシ11を搭載した透明テーブル12をリードピン10iの整列方向に等速移動する場合について説明したが、この等速移動は、リードピン10iと斜向投光器13及び斜向受光器14から構成される1組の投受光器との相対的な関係であるため、リードピン10iの方を移動させる代わりに、投受光器の方を等速移動させてもよい。

【0048】また、ブラシ11のリードピン10iの幅W及び間隔Lは極めて小さいため、厳密な等速移動を行うことが困難な場合もある。このような場合には、等速駆動機の代わりに、透明テーブル12をリードピン10iの整列方向に移動させる駆動機及びその駆動機による移動速度を検出する相対速度検出センサを設置すればよい。

【0049】この場合、受光器の出力信号を処理する回路構成を示すブロックダイアグラムは、図5に示されるように、図2のブロックダイアグラムに相対速度検出センサ23が加わり、この相対速度検出センサ23から各時刻における速度信号Vが高さずれ量演算回路19及び消失ピン数演算回路20に送られることとなる。従って、高さずれ量演算回路19においては、（3）式における

$(T_1 - T_2) \times Vo$

の代わりに、

【0050】

【数1】

$$\int_{T1}^{T1} V \cdot dT$$

を用いて演算がなされ、j番目のリードピン10iの高さずれ量Δ2iは、

【0051】

【数2】

$$\Delta Zj = \left\{ \int_{T1}^{Tj} V \cdot dT - (W+L) \times (l-1) \right\} \times \tan \phi \quad \cdots (6)$$

となる。また、消失ピン数演算回路２０においては、
（５）式における
（Ｔｋ－Ｔ′１）×Ｖｏ
の代わりに、
【００５２】
【数３】

$$\int_{T'j}^{Tk} V \cdot dT$$

$$m = \left(\int_{T'j}^{Tk} V \cdot dT - L \right) \Big/ (W+L) \quad \cdots (7)$$

となる。尚、（３）、（５）式における
（Ｔ１－Ｔ。）×Ｖｏ
及び
（Ｔｋ－Ｔ′１）×Ｖｏ
は共に変位を表すものであるため、上記のような速度情報に基づく代わりに、距離検出手段を用いることにより、ある基準位置からリードピン１０ｉまでのリードピン１０１の整列方向の距離を求めてもよい。
【００５４】この場合、受光器の出力信号を処理する回路構成を示すブロックダイアグラムは、図６に示されるように、図２のブロックダイアグラムに距離検出センサ２４が加わり、オン／オフ時刻カウンタ１７及びオフ／オン時刻カウンタ１８の代わりに、オン／オフ時刻Ｔ１における所定の基準位置からリードピン１０１の左側面※までの距離Ｌｉをカウントするオン／オフ時距離カウンタ２５及びオフ／オン時刻Ｔ′１における所定の基準位置からリードピン１０１の右側面までの距離Ｌ′ｉをカウントするオフ／オン時距離カウンタ２６が、それぞれ時刻検出回路１５及び距離検出センサ２４に接続されて設置される。従って、高さずれ量演算回路１９においては、距離カウンタ２５から送られてくるｊ番目のリードピン１０ｉの左側面までの距離Ｌｊに基づき、（３）式における
（Ｔ１－Ｔ。）×Ｖｏ
の代わりに、
Ｌ１－Ｌ。
を用いて演算がなされ、ｊ番目のリードピン１０１の高さずれ量△Ｚ１は、

$$\Delta Zi = \{ (Li - L_1) - (W+L) \times (i-1) \} \times \tan \phi \quad \cdots (8)$$

となる。
【００５５】また、消失ピン数演算回路２０においては、距離カウンタ２６から送られてくるｊ番目のリードピン１０ｉの右側面までの距離Ｌ′１及び距離カウンタ２５から送られてくるｊ番目の次のリードピン１０ｋの★

$$m = (Lk - L'i - L) / (W+L)$$

となる。また、ｊ番目のリードピン１０ｉの左側面まで☆

$$L1 = L'1 - W$$

であるから、

$$m = \{ (Lk - Li) - (W+L) \} / (W+L)$$

としてもよい。
【００５６】尚、このときの距離検出手段としては、具体的にはリニア測長器、ロータリーエンコーダ、パルスモータへの送出パルスカウント、レーザスキャンによるポリゴンミラーの回転角検出等が考えられる。また、上記第１の実施例においては、複数のリードピン１０１の※までの距離Ｌｉをカウントするオン／オフ時距離カウンタ２５及びオフ／オン時刻Ｔ′１における所定の基準位置からリードピン１０１の右側面までの距離Ｌ′ｉをカウントするオフ／オン時距離カウンタ２６が、それぞれ時刻検出回路１５及び距離検出センサ２４に接続されて設置される。従って、高さずれ量演算回路１９においては、距離カウンタ２５から送られてくるｊ番目のリードピン１０ｉの左側面までの距離Ｌｊに基づき、（３）式における
（Ｔ１－Ｔ。）×Ｖｏ
の代わりに、
Ｌ１－Ｌ。
を用いて演算がなされ、ｊ番目のリードピン１０１の高さずれ量△Ｚ１は、

$$\Delta Zi = \{ (Li - L_1) - (W+L) \times (i-1) \} \times \tan \phi \quad \cdots (8)$$

★左側面までの距離Ｌｋに基づき、（５）式における
（Ｔｋ－Ｔ′１）×Ｖｏ
の代わりに、
Ｌｋ－Ｌ′ｉ
を用いて演算がなされ、消失ピン数ｍは、

$$m = (Lk - L'i - L) / (W+L) \quad \cdots (9)$$

☆の距離Ｌｉは、

$$L1 = L'1 - W \quad \cdots (10)$$

$$m = \{ (Lk - Li) - (W+L) \} / (W+L) \quad \cdots (11)$$

整列方向への位置ずれがないことを前提として、リードピンの高さずれ量△Ｚ及び消失ピン数ｍを計測し、リードピンの欠陥の有無を判別するものであったが、リードピン１０１をもつブラシ１１の製造方法や取扱い方法の如何によっては、垂直方向にずれるのではなく、水平方向にずれて、位置ずれを生じる場合がある。

【0057】勿論、この場合にも、上記第1の実施例によるリードピン検査装置を用いて位置ずれ量ΔXを計測することは可能である。しかし、上記第1の実施例の場合、高さずれ量Δ2を容易かつ正確に計測するために、スポット光の照射角度φが上記（1）式の範囲内でできるだけ小さいことが望ましいとされた。ところが、リードピンの位置ずれ量ΔXを計測する場合、その計測を容易かつ正確にするためには、スポット光の照射角度φを垂直又はそれに近い角度にすることが望ましい。

【0058】そこで、次に、複数のリードピン10₁の整列面から高さ方向へのずれがないことを前提として、リードピンの位置ずれ量ΔX及び消失ピン数mを計測するリードピン検査装置を、第2の実施例として詳述する。本発明の第2の実施例による回転軸へ信号を伝達するブラシのリードピン検査装置を、図7及び図8を用いて説明する。

【0059】図7（a）、（b）、（c）は、検査対象たるブラシをそれぞれ側面及び平面から見たときの1組の投受光器の配置を示す概略図であり、図8は、受光器の出力信号を処理する回路構成を示すブロックダイアグラムである。尚、上記図1及び図2に示すリードピン検査装置と同じ構成要素には同じ符号を付してその説明を省略する。

【0060】この第2の実施例においては、上記第1の実施例の斜向投光器13及び斜向受光器14からなる1組の投受光器がリードピン10₁の整列面に対して斜めに配置されていたのに対し、図7に示されるように、垂＊直投光器27及び垂直受光器28からなる1組の投受光器がリードピン10₁の整列面に対して垂直に配置されている点に特徴がある。

$$\phi = \pi / 2$$

であり、従ってスポット光はリードピン10₁を垂直に照射する。但し、この角度は厳密である必要はなく、垂直に近い角度で照射すればよい。

【0064】こうして、垂直投光器27からのスポット光がリードピン10₁の先端部を照射する一方、リードピン10₁の間を通過したスポット光は、垂直受光器28によって受光される。そしてスポット光の受光器27への入光状態から遮光状態への移行時刻及び遮光状態から入光状態への移行時刻、即ち出力信号のオン／オフ時刻t_i及びオン／オフ時刻t'_1を時刻検出回路15に※

$$t_1 = \{(W+L) \times (j-1) + \Delta X_j\} / V_o + t_1 \quad \cdots (13)$$

となり、従ってj番目のリードピン10jの位置ずれ量★☆★ΔX_1は、

$$\Delta X_j = \{(t_i - t_1) \times V_o - (W+L) \times (j-1)\} \quad \cdots (14)$$

となる。

【0066】尚、第2の実施例によるリードピン検査装置によってリードピンの消失ピン数mを計測する動作　☆は、上記第1の実施例における場合と殆ど同じであり、従って消失ピン数mは、

$$m = \{(t_k - t'_j) \times V_o - L)\} / (W+L) \quad \cdots (15)$$

となる。

【0067】以上のようにして計測したリードピンの位置ずれ量ΔX_1及び消失ピン数mは、データとして計測量記憶回路21に記憶されると共に、欠陥判定回路22において、これらの計数量に基づくリードピンの欠陥についての最終的な判別がなされる。このように第2の実施例によれば、回転軸へ信号を伝達するブラシ11を等速駆動機によってリードピン10₁の整列方向に等速度V_oで移動させつつ、垂直投光器27によってリードピン10₁の先端部をその整列面に対して垂直に照射し、

【0061】尚、受光器の出力信号を処理する回路構成においては、図8に示されるように、高さずれ量演算回路19の代わりに、位置ずれ量演算回路29が設けられていることを除けば、上記第1の実施例の場合とほぼ同様である。次に、第2の実施例によるリードピン検査装置を用いてリードピンの位置ずれ量ΔXを計測する場合を、図8のブロックダイアグラム及び図9に示す受光器の出力信号のタイムチャートを用いて説明する。

【0062】いま、図9（a）に示すように、検査対象たるブラシ11のリードピン10₁のj番目のリードピン10jがリードピン10iの整列方向にブラシ11の移動する向きと逆の向きにΔXjだけずれており、その整列面からの高さずれはないものとする。上記第1の実施例の場合と同様にして、等速駆動機によってブラシ11を搭載した透明テーブル12をリードピン10iの整列方向に等速度V_oで移動させつつ、垂直投光器27からスポット光を照射する。このとき、垂直投光器27からのスポット光は、リードピン10iの先端部を照射することが望ましいのは、上記第1の実施例の場合と同様であるが、リードピン10iの整列面に対する垂直投光器27からのスポット光の照射角度φは大いに異なる。

【0063】即ち、リードピン10iの整列面に対する垂直投光器27からのスポット光の照射角度φは、

$$\cdots (12)$$

※よって検出し、j番目のリードピン10jによるオン／オフ時刻t_jをオン／オフ時刻カウンタ17によってカウントする。

【0065】次いで、位置ずれ量演算回路29において、ピン数カウンタ16からの対象とするリードピンの数j及びオン／オフ時刻カウンタ17からのオン／オフ時刻t_jに基づき、位置ずれ量ΔX_1を演算する。即ち、j番目のリードピン10jのオン／オフ時刻t_jは、

リードピン10iの間を通過したスポット光を垂直受光器28によって受光し、垂直受光器28の出力信号のオン／オフ時刻ti及びオフ／オン時刻t′iを時刻検出回路15によって検出し、位置ずれ量演算回路29及び消失ピン数演算回路20において（14）、（15）式に基づき演算することにより、リードピンの位置ずれ量ΔX及び消失ピン数mを計測することができる。

【0068】従って、これらのリードピンの位置ずれ量ΔX及び消失ピン数mは、データとして計測量記憶回路21に記憶されると共に、欠陥判定回路22においてこれらの計数量に基づきリードピンの欠陥の有無を最終的に判別することができる。尚、上記第1の実施例について述べたように、リードピン10iの方を移動させる代※

$$A \sim 2L + W$$

となっている場合、スポット光がリードピンの先端部を照射すると、図10（b）に示されるように、リードピンが消失している場合と誤認する恐れがある。他方、リ※

$$a < 2L + W$$

となるため、リードピンが消失していると誤認する恐れはない。従って、リードピンの消失ピン数mを計測し、その有無を安定して判別するには、スポット光がリードピン10iの根元部を照射することが望ましい。

【0071】また、上記第1及び第2の実施例は、一方においてリードピン10iの位置ずれがないことを前提として高さずれ量Δ2及び消失ピン数mを計測し、他方においてリードピン10iの高さずれがないことを前提として位置ずれ量ΔX及び消失ピン数mを計測しているが、例えばICパッケージのリードピンの如きは、位置ずれと高さずれとが複合して生じる場合も少なくない。

【0072】そこで、次に、スポット光の照射角度φが上記（1）式の範囲内でできるだけ鋭角であることと垂直又はそれに近い角度にすること、スポット光がリードピンの先端部を照射することと根元部を照射すること等の異なる要求を満足し、位置ずれと高さずれとが複合した変位を計測し、更に上記第1及び第2の実施例では計測不能であったリードピンの集合的な傾斜量の計測することができるリードピン検査装置を、第3の実施例として詳述する。

【0073】次に、本発明の第3の実施例によるICパッケージのリードピン検査装置を、図11及び図12を用いて説明する。図11（a）、（b）は、検査対象たるICパッケージをそれぞれ側面及び平面から見たときの3組の投受光器の配置を示す概略図であり、図12は、受光器の出力信号を処理する回路構成を示すブロックダイアグラムである。

【0074】各側面から複数のリードピン30i（i＝1，2，…，n）が引き出されているICパッケージ31が、光を透過する透明テーブル32上に搭載されている。そしてこの透明テーブル32は、等速駆動機（図示せず）によってリードピン30iの整列方向に等速移動

＊わりに、投受光器の方を等速移動させてもよい。また、等速駆動機の代わりに、駆動機と相対速度検出センサを設置してもよい。更に、距離検出手段を用いてもよい。

【0069】但し、上記第2の実施例においては、位置ずれ量ΔXを容易かつ正確に計測するために、スポット光はリードピン10iの先端部を照射することが望ましいとされる。しかし、リードピンの消失ピン数mを計測する場合には、上記図7に示す場合と異なり、スポット光はリードピン10iの根元部を照射することが望ましい。

【0070】例えば図10（a）に示されるように、リードピンの位置ずれが非常に大きく、先端部でのリードピンの間隔Aが、

…（16）

※ードピンの根元部を照射すると、根元部でのリードピンの間隔aは、どんなに大きな位置ずれであっても、

…（17）

するようになっている。また、透明テーブル32の上方には、それぞれスポット光を照射する第1の垂直投光器33、斜向投光器34、及び第2の垂直投光器35が設置され、その内の第1の垂直投光器33はリードピン30iの先端部をその整列面に対してほぼ垂直に照射し、斜向投光器34はリードピン30iの先端部をその整列面に対して所定の角度φをもって照射し、第2の垂直投光器35はリードピン30iの根元部をその整列面に対してほぼ垂直に照射するようになっている。また、このとき、第1の垂直投光器33と第2の垂直投光器35とは、その設置上、リードピン30iの整列方向に距離bだけ離れている。

【0075】更に、透明テーブル32の下方には、第1の垂直投光器33、斜向投光器34、及び第2の垂直投光器35に相対してそれぞれ第1の垂直受光器36、斜向受光器37、及び第2の垂直受光器38が設置され、リードピン30iの間を通過した第1の垂直投光器33、斜向投光器34、及び第2の垂直投光器35からのスポット光をそれぞれ受光するようになっている。こうしてリードピン30iの整列面を間に挟む3組の投受光器が配置されている。

【0076】また、これら第1の垂直受光器36、斜向受光器37、及び第2の垂直受光器38には、第1の垂直投光器33、斜向投光器34、及び第2の垂直投光器35からのスポット光の入光状態からリードピン30iによる遮光状態への移行時刻又は遮光状態から入光状態への移行時刻、即ち第1の垂直受光器36、斜向受光器37、及び第2の垂直受光器38の出力信号のオン／オフ時刻ti，Ti，τi（i＝1，2，…，n）及びオフ／オン時刻t′i，T′i，τ′i（i＝1，2，…，n）を検出する時刻検出回路39、40、41がそれぞれ接続されている。

【００７７】また、時刻検出回路３９には、リードピン３０ｉの数もカウントするピン数カウンタ４２及びオン／オフ時刻ｔｉをカウントするオン／オフ時刻カウンタ４３が接続され、時刻検出回路４０には、オン／オフ時刻Ｔｉをカウントするオン／オフ時刻カウンタ４４が接続され、時刻検出回路４１には、オン／オフ時刻τ１をカウントするオン／オフ時刻カウンタ４５及びオフ／オン時刻τ′１をカウントするオフ／オン時刻カウンタ４６が接続されている。

【００７８】また、オン／オフ時刻カウンタ４３及びピン数カウンタ４２には、位置ずれ量△Ｘを演算する位置ずれ量演算回路４７が接続され、オン／オフ時刻カウンタ４４及びピン数カウンタ４２には、高さずれ量△Ｚを演算する高さずれ量演算回路４８が接続され、オン／オフ時刻カウンタ４３及びオン／オフ時刻カウンタ４５には、リードピンの集合的な傾斜量△Ｘｓを演算する傾斜量演算回路４９が接続され、オン／オフ時刻カウンタ４５及びオフ／オン時刻カウンタ４６には、リードピンの消失ピン数ｍを演算する消失ピン数演算回路５０が接続されている。

【００７９】更に、ピン数カウンタ４２、位置ずれ量演算回路４７、高さずれ量演算回路４８、傾斜量演算回路４９、及び消失ピン数演算回路５０は、計数量記憶回路５１に接続されると共に、これら位置ずれ量演算回路４７、高さずれ量演算回路４８、傾斜量演算回路４９、及び消失ピン数演算回路５０は、リードピンの欠陥を最終的に判別する欠陥判定回路５２に接続されている。

【００８０】次に、第３の実施例によるリードピン検査装置を用いてリードピンの位置ずれ量△Ｘ及び高さずれ量△Ｚを計測する場合を、図１２のブロックダイアグラム及び図１３に示す受光器の出力信号のタイムチャートを用いて説明する。いま、図１３（ａ）に示すように、検査対象としてのＩＣパッケージ３１の各リードピン３０ｉの幅をＷ、その厚さをＨ、正常に整列された間隔をＬとし、ｊ番目のリードピン３０ｊがリードピン３０１の整列方向にＩＣパッケージ３１の移動する向きと逆の向きに△Ｘｉだけずれ、更にその整列面から垂直な方向に下向きに△Ｚ１だけずれているとする。

＊

$$t_1 = \{(W+L)\times(j-1)+\triangle X_i\}/V_o + t_s \quad \cdots(18)$$

$$T_1 = \{(W+L)\times(j-1)+\triangle X_i+\triangle Z_i/\tan\phi\}/V_o + T_s \quad \cdots(19)$$

となり、従ってｊ番目のリードピン３０ｉの位置ずれ量※ ※△Ｘ１は、

$$\triangle X_j = \{(t_j - t_s)\times V_o - (W+L)\times(j-1)\} \quad \cdots(20)$$

となり、また高さずれ量△Ｚｉは、

$$\triangle Z_1 = \{(T_1 - T_s)\times V_o - (W+L)\times(j-1) - \triangle X_j\}\times\tan\phi$$
$$= \{(T_1 - T_s)\times V_o - (t_j - t_s)\times V_o\}\times\tan\phi \quad \cdots(21)$$

となる。

【００８５】次に、第３の実施例によるリードピン検査装置を用いてリードピンの集合的な傾斜量△Ｘｓを計測

＊【００８１】まず、検査対象たるＩＣパッケージ３１を透明テーブル３２上に搭載した後、この透明テーブル３２を等速駆動機（図示せず）によって複数のリードピン３０ｉの整列方向に等速度Ｖｏで移動させつつ、第１の垂直投光器３３及び斜向投光器３４からスポット光を照射する。そしてこれら第１の垂直投光器３３及び斜向投光器３４からのスポット光は、リードピン３０ｉの先端部を照射する一方、リードピン３０ｉの間を通過して第１の垂直受光器３６及び斜向受光器３７に入光する。

【００８２】そして上記第２の実施例の場合と同様にして、第１の垂直投光器３３からほぼ垂直に照射されたスポット光の第１の垂直受光器３６への入光状態からリードピン３０１による遮光状態への移行時刻及び遮光状態から入光状態への移行時刻、即ち出力信号のオン／オフ時刻ｔ１及びオフ／オン時刻ｔ′１を時刻検出回路３９によって検出し、ｊ番目のリードピン３０ｉによるオン／オフ時刻ｔｊをオン／オフ時刻カウンタ４３によってカウントする。

【００８３】また、上記第１の実施例の場合と同様にして、斜向投光器３４から所定の角度φをもって照射されたスポット光の第２の受光器３７への入光状態からリードピン３０１の左上角（図１３（ａ）中に●で示す）による遮光状態への移行時刻、即ち出力信号のオン／オフ時刻Ｔ１（図１３（ｃ）中に●で示す）及び遮光状態からリードピン３０１の右下角（図１３（ａ）中に○で示す）による入光状態への移行時刻、即ち出力信号のオフ／オン時刻Ｔ′ｉ（図１３（ｃ）中に●で示す）を時刻検出回路４０によって検出し、ｊ番目のリードピン３０ｉによるオン／オフ時刻Ｔｊをオン／オフ時刻カウンタ４４によってカウントする。

【００８４】次いで、位置ずれ量演算回路４７及び高さずれ量演算回路４８において、ピン数カウンタ４２からの対象とするリードピンの数ｊ及びオン／オフ時刻カウンタ４３、４４からのオン／オフ時刻ｔｉ、Ｔｊに基づき、位置ずれ量△Ｘｉ及び高さずれ量△Ｚｉを演算する。即ち、ｊ番目のリードピン３０ｊによるオン／オフ時刻ｔｉ、Ｔｊは、

する場合を、図１２のブロックダイアグラム及び図１４に示すリードピン３０１の拡大平面図を用いて説明する。いま、図１４に示すように、ＩＣパッケージ３１の

リードピン30iが全て一様な位置ずれを生じているとする。このような集合的な傾斜は、第1の垂直投光器33及び斜向投光器34並びに第1の垂直受光器36及び斜向受光器37によっては検出できないため、リードピン30₁の先端部及び根元部をその整列面に対してほぼ垂直に照射する第1及び第2の垂直投光器33．35とこれらに対応する第1及び第2の垂直受光器36．38を用いて検出する。

【0086】位置ずれ量ΔX及び高さずれ量ΔZを計測した場合と同様にして、検査対象たるICパッケージ31を搭載した透明テーブル32をリードピン30iの整列方向に等速度Voで移動させつつ、第1及び第2の垂直投光器33．35からスポット光を照射する。そして第1の垂直投光器33からのスポット光の第1の垂直受光器36への入光状態から遮光状態への移行時刻、即ち＊

$$\Delta Xs = (ti - \tau_1) \times Vo - b \quad \cdots (22)$$

但し、i＝1，2，…，n

となる。

【0088】次に、第3の実施例によるリードピン検査装置における第2の垂直投光器35及び第2の垂直受光器38からなる1組の投受光器を用いて、リードピンの※

$$m = \{(\tau k - \tau' i) \times Vo - L\} / (W + L) \quad \cdots (23)$$

となる。

【0089】以上のようにして計測したリードピンの位置ずれ量ΔX₁，高さずれ量ΔZi、集合的な傾斜量ΔXs，及び消失ピン数mは、データとして計数記憶回路51に記憶されると共に、欠陥判定回路52においてこれらの計数量に基づくリードピンの欠陥についての最終的な判別がなされる。このように第3の実施例によれば、等速駆動機によってICパッケージ31をリードピン30₁の整列方向に等速度Voで移動させつつ、第1の垂直投光器33によってリードピン30iの先端部をその整列面に対してほぼ垂直に照射し、斜向投光器34によってリードピン30₁の先端部をその整列面に対して所定の角度φをもって照射し、第2の垂直投光器35によってリードピン30₁の根元部をその整列面に対してほぼ垂直に照射し、リードピン30₁の間を通過した第1の垂直投光器33，斜向投光器34，及び第2の垂直投光器35からのスポット光をそれぞれ受光した第1の垂直受光器36，斜向受光器37，及び第2の垂直受光器38の出力信号のオン／オフ時刻t₁，T₁，τi及びオフ／オン時刻t′₁，T′i，τ′iを時刻検出回路39．40．41によってそれぞれ検出し、位置ずれ量演算回路47、高さずれ量演算回路48．傾斜量演算回路49．及び消失ピン数演算回路50において（20）～（23）式に基づき演算することにより、それぞれリードピンの位置ずれ量ΔX．高さずれ量ΔZ、集合的な傾斜量ΔXs，及び消失ピン数mを計測することができる。

【0090】従って、これらのリードピンの位置ずれ量

＊第1の垂直受光器36の出力信号のオン／オフ時刻t₁と第2の垂直投光器35からのスポット光の第2の垂直受光器38への入光状態から遮光状態への移行時刻、即ち第2の垂直受光器38の出力信号のオン／オフ時刻τ₁とをそれぞれ時刻検出回路39，41によって検出し、オン／オフ時刻カウンタ43，45によってカウントする。

【0087】次いで、傾斜量演算回路49において、オン／オフ時刻カウンタ43．45からのオン／オフ時刻ti．τ₁に基づき、上記第1の実施例の場合と同様にして、傾斜量を演算する。ここで、リードピン30₁の根元部から先端部までの整列方向の距離ΔXsを、リードピン30₁の集合的な傾斜量とすると、傾斜量ΔXsは、

※消失ピン数mを計測する。この場合の動作は、リードピン30₁の根元部を照射するか先端部を照射するかの違いはあれ、その他は上記第2の実施例における場合と殆と同じである。従って、消失ピン数mは、

ΔX．及び高さずれ量ΔZ．集合的な傾斜量ΔXs，及び消失ピン数mは、データとして計数量記憶回路51に記憶されると共に、欠陥判定回路52においてこれらの計数量に基づきリードピンの欠陥を最終的に判別することができる。尚．第3の実施例においては、上記第1及び第2の実施例の場合と同様に、等速駆動機によってICパッケージ31を搭載した透明テーブル32を等速移動する代わりに．3組の投受光器の方を等速移動させてもよい。

【0091】また、等速駆動機の代わりに、透明テーブル32をリードピン30iの整列方向に移動させる駆動機と．その駆動機による移動速度を検出する相対速度検出センサを設置してもよい。また、リニア測長器等の距離検出手段を用いることにより、速度情報の代わりに距離情報に基づいて、リードピンの位置ずれ量ΔX₁、高さずれ量ΔZ₁．及び消失ピン数mを計測してもよい。

【0092】次に本発明の第4の実施例によるICパッケージのリードピン検査装置を、図15乃至17を用いて説明する。図15は本実施例の原理説明図であり、図16は、図15に示す本実施例の原理に基づき投受光器ユニットとして用いた例を示す図である。図17はリードピン曲がりの検査方法を説明する図である。

【0093】上述した第3の実施例では、1つの投光器と1つの受光器を対として．照射角の異なる2対以上の投受光器ユニットを用いたが、本実施例では、1つの投光器に対して複数の受光器を設けた投受光器ユニットとして構成している。図15の原理説明図では、投光器1個に対して受光器2個を用いた場合について示してい

る。

【００９４】検査対象である、各側面から複数のリードピン１０６が引き出されているＩＣパッケージ１０４が、光を透過する透明テーブル１０８上に搭載されている。透明テーブル１０８の上方には光を照射する投光器１００が設けられ、投光器１００の下部には、投光器１００からの光を集光するレンズ１０２を主体とする光学系が設けられている。

【００９５】透明テーブル１０８の下方には、投光器１００の光軸Ｚ－Ｚ′に対して角度θの方向に２つの受光器１１０が設置されている。投光器１００から発した光は、レンズ１０２を主体とする光学系により集光され、投光器１００の光軸Ｚ－Ｚ′に対し角度θの広がりを持つ光となる。ＩＣパッケージ１０４に対してθの角度で斜めに入射した光は、リードピン１０６の間を通過し、受光器１１０に入射する。

【００９６】このようにして左右の受光器１１０に入射する光は、ＩＣパッケージ１０４に対して互いに異なる角度で照射される。したがって、異なる照射角を持つ光を一つの投光器１００で実現することができる。本実施例によるリードピン検査装置の投受光器ユニットは、図１６に示すように、１個の投光器１００と４個の受光器１１２、１１４、１１６、１１８を、コの字形状をした支持フレーム１２０に一体化して形成している。４つの受光器１１２、１１４、１１６、１１８は、光学系１２２で集光されたスポット１２４のほぼ中央で直行する２直線、Ｘ－Ｘ′及びＹ－Ｙ′の上に配置している。また、検査するＩＣパッケージ１０４は、光学系１２２と複数の受光器１１２、１１４、１１６、１１８との間に置かれる。なお、ＩＣパッケージ１０４は透明テーブル１０８上に乗せられるが、ここでは簡略化のためＩＣパッケージ１０４のみを図示した。

【００９７】いま、検査するＩＣパッケージ１０４のリードピン１０６の整列方向をＹ－Ｙ′方向に合わせ、その相対運動方向もＹ－Ｙ′方向（図中の矢印方向）とする。このとき、受光器１１２及び１１４に入射した光は、相対運動方向に対して垂直な方向に偏向しているのでリードピン１０６に対しては垂直入射光とみなすことができる。また、受光器１１６及び１１８に入射した光は、相対運動方向に偏向しているのでリードピン１０６に対しては斜め入射光とみなすことができる。

【００９８】このように、本実施例による投受光器ユニットを用いることにより、２つの垂直方向の投受光器ユニットと、２つの斜め方向の投受光器ユニットを用いることと同様の機能を得ることができる。従って、上記第３の実施例に示したように、リードピン１０６の位置ズレ量、高さズレ量、集合的な傾斜量、及び消失ピン数を計測することができる。

【００９９】次に本実施例における測定の一例として、リードピン曲がりの測定について説明する。図１７に示すようにＸ－Ｘ′方向にαの角度の曲がりのあるリードピン１０６が検査対象の場合、リードピン１０６がＹからＹ′方向に移動すると受光器１１４に入射する光はリードピン１０６がＡ点に到達した時に遮られるが、受光器１１２に入射する光はリードピン１０６がＢ点に到達するまで光を遮らない。このことを利用し、Ａ点とＢ点との距離を相対速度検出センサー２３や距離検出センサー２４を用いて検出することで、リードピンの曲がり角αやピン消失を計算から求めることができる。

【０１００】このように本実施例によれば、一個の投光器と複数の受光器により構成された投受光器ユニットによりリードピンのあらゆる検査が可能である。また、１つの投受光器ユニットで一通の検査が可能であるため取付スペースを縮小できる。さらに、４つの受光器間の距離を縮めることができるため、検査する際のリードピンの移動距離も短くなり、検査処理時間が短縮できる。

【０１０１】なお、図１５に示す投受光器ユニットでは、投光器１００から発した光を直接受光器１１０で受けていたが、図１８に示すように光ファイバー等の光を伝達する線状の部材１５６を複数配置し、さらにその先に受光器１１０を接続することで受光機能をもたせてもよい。また、図１９に示すように、受光器あるいは光ファイバー等の光を伝達する線状の部材１５６の前方に、ピンホールのような微細な孔１５８の開いたマスク１６０を配置し、受光する光の強さを調節したり外乱光の侵入を阻止して受光機能の安定化をはかってもよい。

【０１０２】また、図１５の投受光器ユニットでは、受光器１１０を同一円周上に配置したが、光の強さがほぼ等しい点であれば、円周上に限らず楕円などの他の形状の外周上に配置してもよい。次に本発明の第５の実施例によるＩＣパッケージのリードピン検査装置を、図２０乃至２４を用いて説明する。

【０１０３】図２０は、本実施例の原理説明図である。図２１は本実施例によるリードピン検査装置を説明する概略図であり、図２２はリードピン検査装置の信号処理回路を示すブロックダイアグラムである。図２３及び図２４は図２１に示したリードピン検査装置の動作説明図である。上述した第４の実施例では、図１６に示す投受光器ユニット１つでリードピン検査が可能であることを示した。本実施例のリードピン検査装置では、図１６に示した投受光器のもう一つの利点である双方向性を利用している。

【０１０４】図２０を用いて本実施例の原理について説明する。図２０（ａ）は、リードピン１０６が左から右に移動した場合の原理を、図２０（ｂ）は、リードピン１０６が右から左に移動した場合の原理を示している。なお、図中のＹ－Ｙ′は図１６の記号に対応している。リードピン１０６を右から左に移動した場合、受光器１１６に入射する光はリードピン１０６の下面エッジＢ点で遮られ、また、受光器１１８に入射する光はリードピ

ン106の上面エッジA点で遮られる。リードピンを左から右に移動した場合には、受光器118に入射する光はリードピン106の下面エッジC点で遮られ、また、受光器116に入射する光はリードピン106の上面エッジD点にて遮られる。

【0105】リードピン106の検査を行う際、リードピン106の検出面（上面あるいは下面）は統一することが望ましいため、Y－Y′方向に一つの受光器しかもたない場合にはリードピン106の移動方向は右から左、あるいは左から右の一方向に限定される。しかし、受光器を2個配置することにより、リードピン106は左右両方向に移動することが可能となる。但し、その際には移動方向に応じて検出する受光器116あるいは118を選択する必要がある。つまりリードピン106の上面を検出面とした場合は、左方向に移動する際には受光器118を用いてA点を検出し、右方向に移動する際には受光器116を用いてD点を検出すればよい。

【0106】図21を用いて本実施例によるリードピン検査装置を説明する。図21（a）及び（b）はそれぞれ、リードピン装置の上面図と側面図を示している。土台128に固定されたスライドガイド130上には、左右に移動するスライドテーブル132が設けられている。スライドテーブル132には、リードピン106を検査するための4つの投受光器ユニット134、136、138、140が設けられている。なお、投受光器ユニット134、136、138、140は図16に示したものである。また、投受光器ユニット134、136、138、140の投光器110と受光器112、114、116、118との間には、検査するICパッケージ104を乗せるためのワーク支持台152が配置されている。

【0107】ICパッケージ104を搬送する移載ロボット142は、土台128に固定された軸柱144に取り付けられ、軸柱144を中心に回転する。また、移載ロボット142には、先端にICチャック148が取り付けられた、直角に交差する4本のアーム146が設けられており、同時に4つのICパッケージ104を運ぶことができる。

【0108】また、図21（b）に示すように軸柱144は上下移動が可能で、ICパッケージ104をグリップあるいはリリースする際には下に移動し、移載ロボットを回転する際には上に移動する。図22を用いて、投受光器ユニット134、136、138、140の出力信号を処理する回路構成を説明する。

【0109】それぞれの投受光器ユニットの第1の垂直受光器112、及び第2の垂直受光器114には時刻検出回路39、41がそれぞれ接続されている。また、第1の斜向受光器116及び第2の斜向受光器118は切り替え器162を介して時刻検出回路40に接続されている。切り替え器162は、切り替え信号に基づいて時刻検出回路40に受光器116と118のどちらを接続するかを切り替える働きをする。

【0110】その他については第3の実施例と同様であるので説明は省略する。次に、図21及至24を用いて本実施例のリードピン検査装置の動作を説明する。図23はリードピン検査の際の往復スライドテーブル132の動作を示しており、図24はICパッケージ104が移載ロボット142により運ばれる際のリードピンの位置を示す図である。

【0111】いま、図24に示すような4辺にリードピンをもつ四角形のICパッケージ104を検査することとする。ICパッケージ104は、リードピン106の配置を示すインデックスマーク164を左下にした状態で供給ステージ150に供給される。供給ステージ150に供給されたICパッケージ104は移載ロボット142によりワーク支持台152のA点に運ばれる。A点は、移載ロボット142の軸柱144を中心にして、供給ステージ150から90°の位置にある。つまり、供給ステージ150にて供給されたICパッケージ104はA点に移動することで90°回転し、ICパッケージ104のインデックスマーク164は左上に移動する。

【0112】A点に置かれたICパッケージ104を検査するためには、図23（a）に示す位置にある往復スライドテーブル132を右方向に移動すればよい。それにより、投受光器ユニット134及び136を用いてICパッケージ104の上下2辺のリードピン検査を行う。すなわち、第1のリードピン列166と第2のリードピン列168が、それぞれ投受光器ユニット134と136により検査される。

【0113】A点での検査が終了すると、ICパッケージ104は移載ロボット142によりワーク支持台152のA点からワーク支持台152のB点に運ばれる。同様に、B点は移載ロボット142の軸柱144を中心にして、A点から90°の位置にある。このため、ICパッケージ104はさらに90°回転し、インデックスマークは右上に移動する。また、A点で検査した第1のリードピン列166と第2のリードピン列168はそれぞれICパッケージ104の右側及び左側となる。

【0114】上記の検査により、往復スライドテーブル132はスライドガイド130の右側に移動し、図23（b）に示すように、B点の右側に投受光器ユニット138及び140が位置することになる。従って、B点に置かれたICパッケージ104を検査するためには、今度は往復スライドテーブル132を左方向に移動すればよい。それにより、投受光器ユニット138及び140を用いてICパッケージ104の残り2辺のリードピン検査を行う。すなわち、第3のリードピン列170と第4のリードピン列172を、それぞれ投受光器ユニット138と140により検査する。

【0115】なお、前述したように往復スライドテーブ

ル１３０の移動方向を逆にする際には斜向方向の受光器１１６及び１１８を切り替える必要があるので、切り替え器１６２を用いて時刻検出回路４０に接続する斜向方向の受光器を切り替える。Ｂ点での検査が終了すると、ＩＣパッケージ１０４はワーク支持台１５２のＢ点から移載ロボット１４２により取り出しステージ１５４に運ばれ、ここで検査工程を終了する。

【０１１６】また、上記一連の手順において、ワーク支持台１５２のＡ点及びＢ点では異なるＩＣパッケージ１０４を同時に検査することが可能である。このように本実施例によれば、一個の投光器と複数の受光器を持った一組の投受光器ユニットは、２つの斜向受光器を切り替えることにより、リードピン整列方向に対する移動方向を固定する必要ない。このため、図２１に示すようなリードピン検査装置として用いた際には検査のたびに往復スライドテーブル１３２を戻す必要がなく、検査時間を短縮することができる。

【０１１７】次に、本発明の第６の実施例による２つの面の相対的位置を制御する位置制御装置を、図２５を用いて説明する。図２５（ａ）、（ｂ）は、それぞれ制御対象たる２つの面を側面から見たときの１組の投受光器の配置を示す概略図であり、図２５（ｃ）は、その位置＊

$$f = D - d$$

となる。

【０１２０】従って、投光器６１からスポット光を照射している状態で、駆動機によってステージ６３をｚ軸方向に移動していくと、Ａ面とＢ面との距離がＤになったときに、図２５（ｃ）に示されるように、受光器６２から所定の検出信号が出力される。このように第６の実施例によれば、平行に対面するＡ面及びＢ面に、それらの面に立てた法線から角度φだけ傾けて投光器６１及び受光器６２を固定すると共に、一方のＢ面を駆動機によってｚ軸方向に移動することにより、Ａ面とＢ面とが所定の距離Ｄになったときに投光器６１からのスポット光が受光器６２によって受光され、所定の検出信号が出力されるため、光学系６０のワーキング・ディスタンスｆに容易にかつ正確に制御することができる。また、受光器６２の出力と駆動機とを接続し、所定の検出信号によって移動を自動的に停止させることにより、光学系６０の自動フォーカスが可能となる。

【０１２１】尚、上記第６の実施例においては、駆動機はステージ６３をｚ軸方向にだけ移動するものであるが、更にｘ軸方向及びｙ軸方向にも移動する駆動機を取り付けてもよい。この場合、光学系６０の自動フォーカスのみならず、光学系６０とＢ面上の観測対象とのｘ軸方向及びｙ軸方向の位置合わせも可能となる。また、こうした駆動機による移動はＢ面側に限らず、Ａ面側を移動させてもよいし、又は両面を共に移動させてもよい。

【０１２２】また、上記第６の実施例においては、Ａ面に投光器６１を固定し、Ｂ面に受光器６２を固定してい

＊制御装置の受光器の出力信号のタイムチャートである。

【０１１８】図２５（ａ）に示されるように、Ａ面及びＢ面という２つの面が、ある間隔をおいて平行に対面している。そしてＡ面には、例えばテレビカメラ等が接続されている光学系６０が固定されており、その光学系６０の先端部は、Ａ面から下方に距離ｄだけ突き出ている。またＡ面には、スポット光を照射する投光器６１が、Ａ面に立てた法線から角度φだけ傾けて固定されている。

【０１１９】他方のＢ面には、スポット光を受光する受光器６２が、投光器６１の光軸とＢ面に立てた法線とのなす平面内に、Ｂ面に立てた法線から角度φだけ傾けて固定されている。またＢ面の下面には、ステージ６３が取り付けられ、駆動機（図示せず）によってｚ軸方向にだけ移動することができるようになっている。また、図２５（ｂ）に示されるように、Ａ面に固定された投光器６１とＢ面に固定された受光器６２とは、Ａ面とＢ面との間隔が所定の距離Ｄになったときに互いの光軸が一致し、投光器６１からのスポット光が受光器６２によって受光されるように配置されている。そしてこのとき、光学系６０先端部からＢ面までの距離、即ち光学系６０のワーキング・ディスタンス（焦点が合う距離）ｆは、

$$\cdots (24)$$

るが、互いに逆に取り付けてもよい。また、上記第６の実施例においては、Ａ面及びＢ面が平行に対面している場合について説明したが、平行でない場合にも本発明を適用することができる。この場合は、Ａ面とＢ面との距離Ｄの制御ではなく、Ａ面内の所定の点とＢ面内の所定の点との距離を制御することになる。

【０１２３】また、投光器６１から照射するスポット光は、十分に絞られていることが望ましい。図２５（ｂ）に示される受光器６２から出力される所定の検出信号の幅が限りなく小さくなり、従って光学系６０のワーキング・ディスタンスｆが高精度に制御されることになるからである。次に、本発明の第７の実施例による２つの面の相対的位置を制御する位置制御装置を、図２６及び図２７を用いて説明する。

【０１２４】図２６（ａ）、（ｂ）は、それぞれ制御対象たる２つの面を側面から見たときの３組の投受光器の配置を示す概略図であり、図２７は、その位置制御装置の受光器の出力信号の検出図である。図２６（ａ）に示されるように、Ａ面及びＢ面という２つの面が、ある間隔をおいて対面しているが、平行であるとは限らない。そしてＡ面には、スポット光を照射する第１乃至第３の投光器６４、６５、６６が固定されている。その内の第１の投光器６４はＡ面に垂直に取り付けられ、第２の投光器６５はＡ面に立てた法線から角度φだけ傾けて取り付けられ、第３の投光器６６はＡ面に立てた法線から角度φだけ傾けて取り付けられている。

【０１２５】他方のＢ面には、スポット光を受光する第

1乃至第3の受光器67．68、69が、それぞれ第1乃至第3の投光器64、65、66に相対して固定されている。即ち．第1の受光器67はB面に垂直に取り付けられ、第2の受光器68はB面に立てた法線から角度φだけ傾けて取り付けられ．第3の受光器69はB面に立てた法線から角度φだけ傾けて取り付けられている。

【0126】また、A面又はB面の位置を動かす駆動機（図示せず）が設けられており、この駆動機によって、A面とB面とのなす距離及びA面とB面とのなす対面角度を変化させることができるように配置されている。そしてA面に固定された第1乃至第3の投光器64．65．66とB面に固定された第1乃至第3の受光器67．68、69とは、図16（b）に示されるように、A面とB面とが平行になり．かつA面とB面との間隔が所定の距離Dになったときに3組の投受光器の光軸がそれぞれ一致し．第1乃至第3の投光器64、65．66からのスポット光が第1乃至第3の受光器67．68、69によってそれぞれ受光されるように設定されている。

【0127】従って、第1乃至第3の投光器64．65．66からスポット光を照射している状態で．駆動機によってA面又はB面を動かし、A面とB面とのなす距離及びA面とB面とのなす対面角度を変化させていくと．A面とB面とが平行になり、かつA面とB面との間隔が所定の距離Dになったときに、図27に示されるように．第1乃至第3の受光器67、68、69から所定の検出信号がそれぞれ出力される。

【0128】このように第7の実施例によれば．対面するA面及びB面に、第1乃至第3の投光器64．65、66と第1乃至第3の受光器67、68、69とからなる3組の投受光器をそれぞれ異なる方向に取り付けると共に．駆動機によってA面とB面とのなす距離及びA面とB面とのなす対面角度を変化させることにより．A面とB面とが平行になり、かつA面とB面との間隔が所定の距離Dになったときに．第1乃至第3の投光器64、65．66からのスポット光が第1乃至第3の受光器67．68、69によって受光され、所定の検出信号がそれぞれ出力されるため、対面するA面及びB面が所定の距離Dをおいた平行な位置になるように容易にかつ正確に制御することができる。従って、第1乃至第3の受光器67、68．69の各出力と駆動機とを接続することにより、所定の距離Dをおいた A面とB面との平行度の自動制御が可能となる。

【0129】尚．上記第7の実施例においては．第1の投光器64はA面に垂直に．第2の投光器65はA面に立てた法線から角度φだけ傾けて、第3の投光器66はA面に立てた法線から角度φだけ傾けてそれぞれ固定され．また、これら第1乃至第3の投光器64、65、66に相対して第1乃至第3の受光器67、68．69がB面に固定されているが．例えば図28に示すように、その中の第3の投光器66の代わりに．第1の投光器64と同様にA面に垂直に固定した第3の投光器70を用い．この第3の投光器70に相対して．第3の受光器69の代わりに第3の受光器71をB面に垂直に固定しても．同様の効果を奏することができる。異なる位置に固定された3組の投受光器の内、少なくとも2組の投受光器の方向が異なれば、A面及びB面の相対的な位置を確定することができるからである。

【0130】また、上記第7の実施例においては．A面とB面とが平行になるように制御する場合について説明したが、A面及びB面に固定する組の投受光器の取り付け位置及びその方向を調整することにより、A面及びB面が平行になる場合に限らず、所定の対面角度になるように制御することも可能である。

【0131】

【発明の効果】以上のように本発明によれば、所定の間隔をおいて整列された複数のリードピンを検査するリードピン検査装置において．駆動手段によって投受光器又は被検査物を搭載したステージを複数のリードピンの整列方向に移動させつつ、投受光器によって複数のリードピンの整列面に所定の角度をもってスポット光を照射すると共に、そのリードピンの間を通過したスポット光を受光し、受光器の入光状態から遮光状態への移行時刻又は遮光状態から入光状態への移行時刻を時刻検出手段によって検出し．その移行時刻に基づき．各リードピンの正常な位置からの変位量又はリードピンの欠損数を演算手段によって計測し、その計測量に基づき、複数のリードピンにおける欠陥の有無を欠陥判定手段によって判定することができる。

【0132】これにより．リードピンの位置ずれ．高さずれ．消失、集団的傾斜等の欠陥を高速、高精度．低価格で．安定的に検査することが可能となる。また．対面する第1の面と第2の面との相対的位置を制御する位置制御装置において、投光器が固定された第1の面又は受光器が固定された第2の面の位置を駆動手段によって変化させ、第1の面と第2の面とが所定の相対的な位置になるときに互いの光軸を一致させることにより．第1の面と第2の面とを所定の相対的位置に制御することができる。

【0133】これにより．対面する2つの面の相対的位置を高速、高精度、低価格で、安定的に制御することが可能となる。

【図面の簡単な説明】

【図1】本発明の第1の実施例による回転軸へ信号を伝達するブラシのリードピン検査装置を説明するための概略図である。

【図2】図1のリードピン検査装置における斜向遮光受光器の出力信号を処理する回路構成を示すブロックダイアグラムである。

【図3】図1のリードピン検査装置における斜向受光器

33

の出力信号のタイムチャートである。
【図４】図１のリードピン検査装置における斜向受光器の出力信号のタイムチャートである。
【図５】図１のリードピン検査装置の第１の変形例における斜向受光器の出力信号を処理する回路構成を示すブロックダイアグラムである。
【図６】図１のリードピン検査装置の第２の変形例における斜向受光器の出力信号を処理する回路構成を示すブロックダイアグラムである。
【図７】本発明の第２の実施例による回転軸へ信号を伝達するブラシのリードピン検査装置を説明するための概略図である。
【図８】図７のリードピン検査装置における垂直受光器の出力信号を処理する回路構成を示すブロックダイアグラムである。
【図９】図７のリードピン検査装置における垂直受光器の出力信号のタイムチャートである。
【図１０】リードピンの消失ピン数ｍを計測する場合に、スポット光はリードピンの根元部を照射することが望ましいことを説明するための図である。
【図１１】本発明の第３の実施例によるＩＣパッケージのリードピン検査装置を説明するための概略図である。
【図１２】図１１のリードピン検査装置における垂直受光器及び斜向受光器の出力信号を処理する回路構成を示すブロックダイアグラムである。
【図１３】図１１のリードピン検査装置における垂直受光器及び斜向受光器の出力信号のタイムチャートである。
【図１４】図１１のリードピン検査装置におけるリードピンの拡大平面図である。
【図１５】本発明の第４の実施例によるリードピン検査装置の投受光器の原理を説明するための図である。
【図１６】本発明の第４の実施例によるリードピン検査装置に用いる投受光器の動作を説明するための概略図である。
【図１７】図１５の投受光器の変形例を説明するための図である。
【図１８】図１５の投受光器の変形例を説明するための図である。
【図１９】図１６の投受光器を用いてリードピンの曲がりを検査する過程を説明するための図である。
【図２０】本発明の第５の実施例によるリードピン検査装置の原理説明図である。
【図２１】本発明の第５の実施例によるリードピン検査装置を説明するための概略図である。
【図２２】図２１のリードピン検査装置における垂直受光器及び斜向受光器の出力信号を処理する回路構成を示すブロックダイアグラムである。
【図２３】図２１のリードピン検査装置における往復スライドテーブルの動作を説明するための概略図である。

34

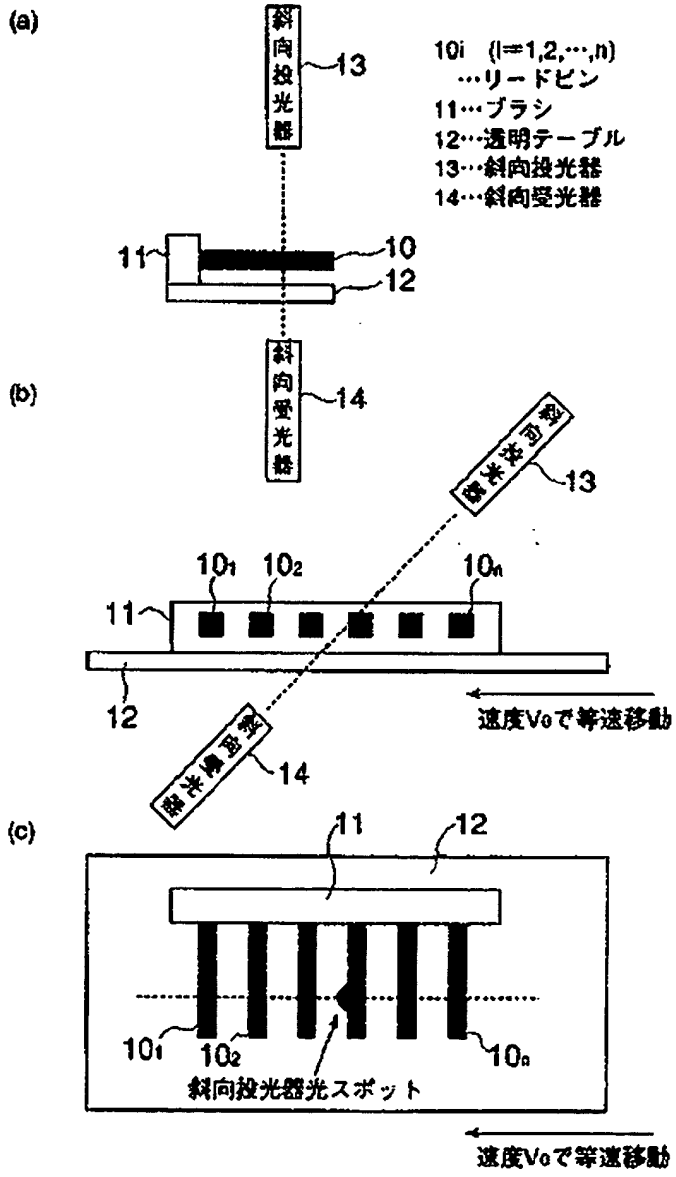
【図２４】図２１のリードピン検査装置におけるＩＣパッケージの移動を説明するための概略図である。
【図２５】本発明の第６の実施例による位置制御装置を説明するための概略図である。
【図２６】本発明の第７の実施例による位置制御装置を説明するための概略図である。
【図２７】図２６の位置制御装置の受光器の出力信号の検出図である。
【図２８】図２６の位置制御装置の変形例を説明するための概略図である。
【図２９】従来のリードピン検査方法を説明するための概略図である。
【図３０】従来のリードピン検査方法を説明するための概略図である。
【図３１】従来のリードピン検査方法を説明するための概略図である。
【図３２】従来の位置制御方法を説明するための概略図である。
【符号の説明】
１０ｉ（ｉ＝１，２，…，ｎ）…複数のリードピン
１１…ブラシ
１２…透明テーブル
１３…斜向投光器
１４…斜向受光器
１５…時刻検出回路
１６…ピン数カウンタ
１７…オン／オフ時刻カウンタ
１８…オフ／オン時刻カウンタ
１９…高さずれ量演算回路
２０…消失ピン数演算回路
２１…計測登記憶回路
２２…欠陥判定回路
２３…相対速度検出センサ
２４…距離検出センサ
２５…オン／オフ時距離カウンタ
２６…オフ／オン時距離カウンタ
２７…垂直投光器
２８…垂直受光器
２９…位置ずれ量演算回路
３０ｉ（ｉ＝１，２，…，ｎ）…複数のリードピン
３１…ＩＣパッケージ
３２…透明テーブル
３３…第１の垂直投光器
３４…斜向投光器
３５…第２の垂直投光器
３６…第１の垂直受光器
３７…斜向受光器
３８…第２の垂直受光器
３９，４０，４１…時刻検出回路
４２…ピン数カウンタ

４３…オン／オフ時刻カウンタ
４４…オン／オフ時刻カウンタ
４５…オン／オフ時刻カウンタ
４６…オフ／オン時刻カウンタ
４７…位置ずれ量演算回路
４８…高さずれ量演算回路
４９…傾斜量演算回路
５０…消失ピン数演算回路
５１…計数量記憶回路
５２…欠陥判定回路
６０…光学系
６１…投光器
６２…受光器
６３…ステージ
６４…第１の投光器
６５…第２の投光器
６６…第３の投光器
６７…第１の受光器
６８…第２の受光器
６９…第３の受光器
７０…第３の投光器
７１…第３の受光器
８０ｉ（ｉ＝１，２，…，ｎ）…複数のリードピン
８１…ＩＣパッケージ
８２…ＣＣＤカメラ
８３…変位センサ
８４…発光器
８５…受光器
８６…レーザ測長器
８７…反射ミラー
１００…投光器
１０２…レンズ
１０４…ＩＣパッケージ
１０６…リードピン

１０８…透明テーブル
１１０…受光器
１１２…受光器
１１４…受光器
１１６…受光器
１１８…受光器
１２０…支持フレーム
１２２…光学系
１２４…スポット
１２６…リードピン
１２８…土台
１３０…スライドガイド
１３２…往復スライドテーブル
１３４…投受光器ユニット
１３６…投受光器ユニット
１３８…投受光器ユニット
１４０…投受光器ユニット
１４２…移載ロボット
１４４…軸柱
１４６…アーム
１４８…ＩＣチャック
１５０…供給ステージ
１５２…ワーク支持台
１５４…取り出しステージ
１５６…光ファイバー
１５８…微細な孔
１６０…マスク
１６２…切り替え器
１６４…インデックスマーク
１６６…第１のリードピン列
１６８…第２のリードピン列
１７０…第３のリードピン列
１７２…第４のリードピン列

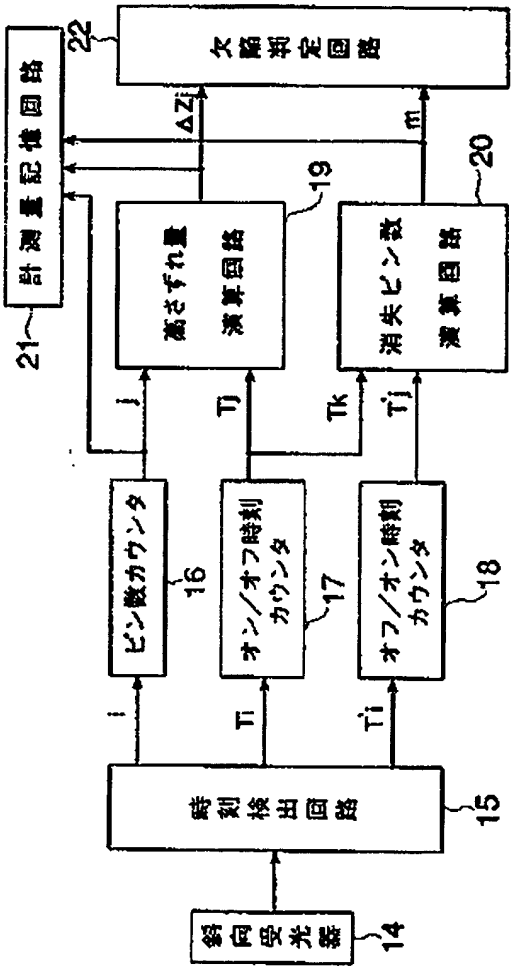
【図1】

本発明の第1の実施例による回転軸へ信号を伝達するブラシのリードピン検査装置を説明するための概略図



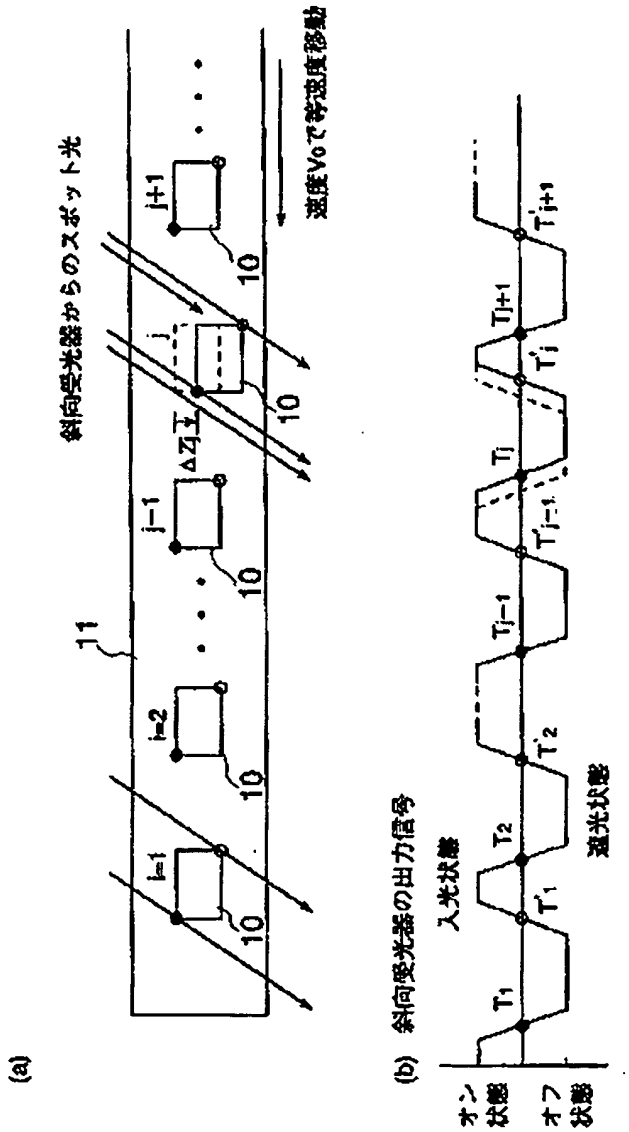
【図2】

図1のリードピン検査装置における斜向受光器の
出力信号を処理する回路構成を示すブロックダイアグラム



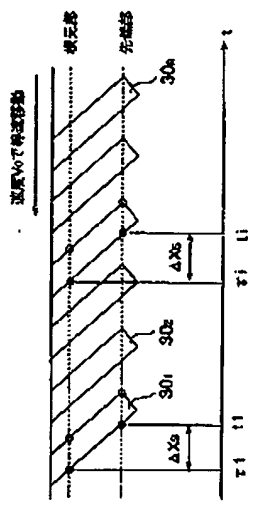
【図3】

図1のリードピン検査装置における
斜向受光器の出力信号のタイムチャート



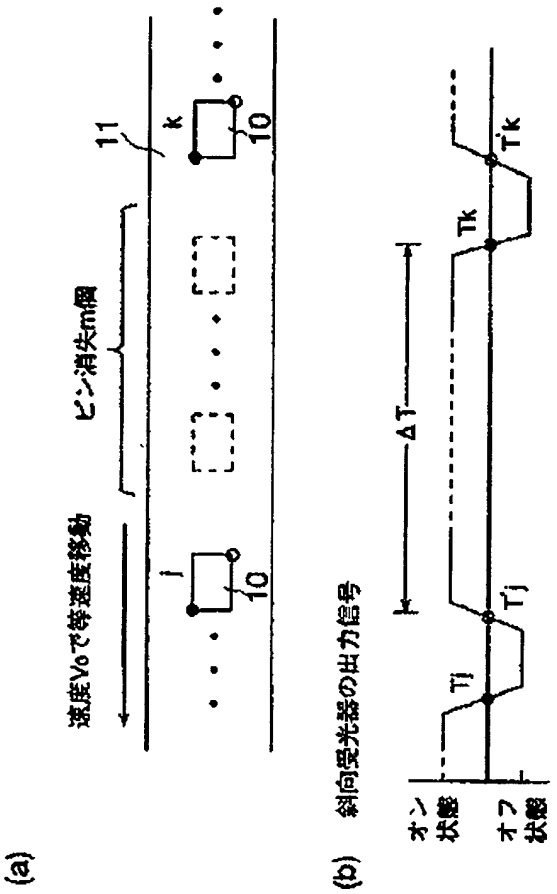
【図14】

図11のリードピン検査装置における
リードピンの拡大平面図



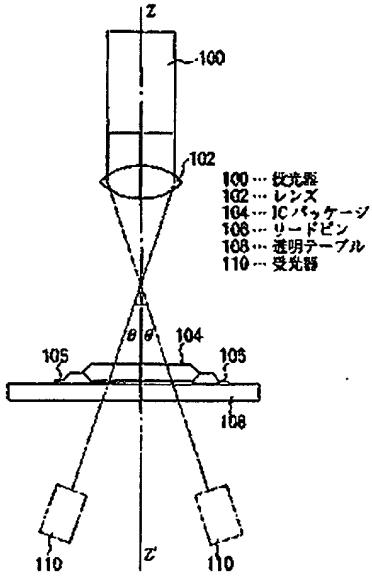
【図4】

図1のリードピン検査装置における
斜向受光器の出力信号のタイムチャート



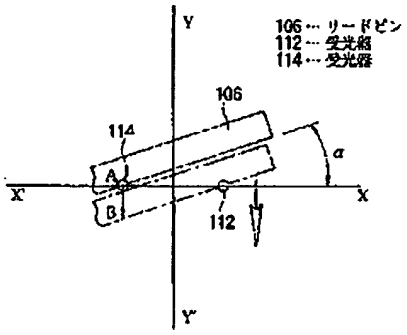
【図15】

本発明の第4の実施例によるリードピン検査装置の
投受光器の原理を説明するための図



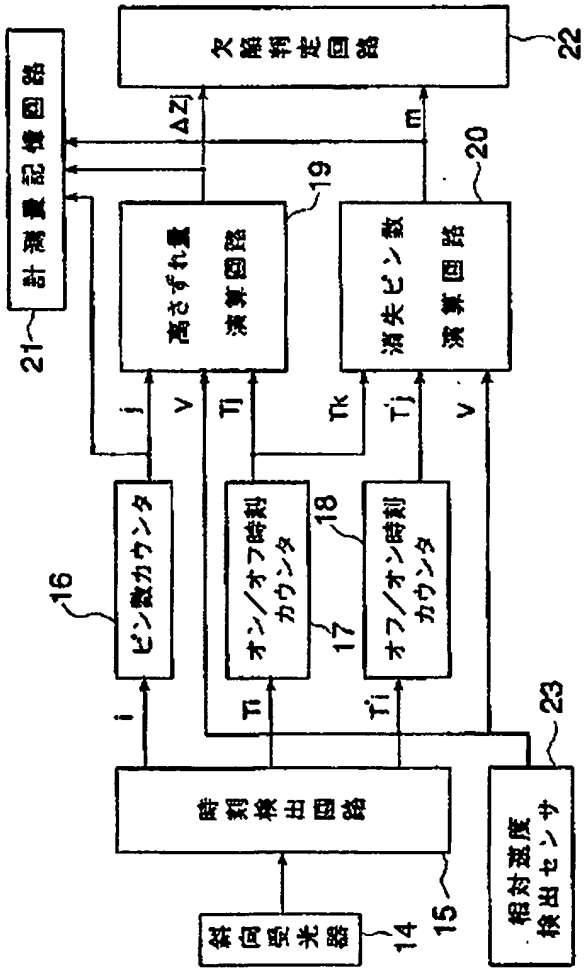
【図17】

図16の投受光器を用いてリードピンの曲がりを
検査する過程を説明するための図



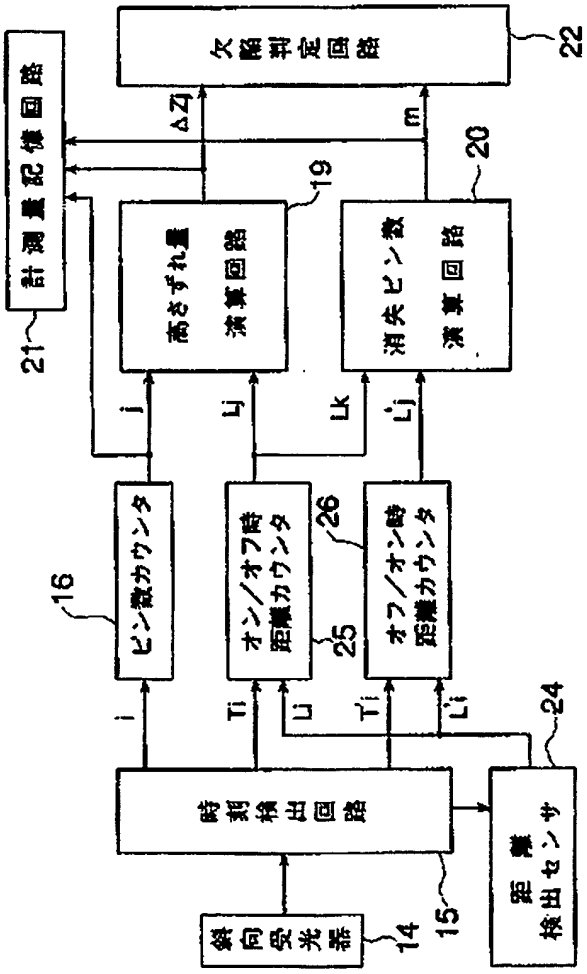
【図5】

図1のリードピン検査装置の第1の変形例における斜向受光器の出力信号を処理する回路構成を示すブロックダイアグラム



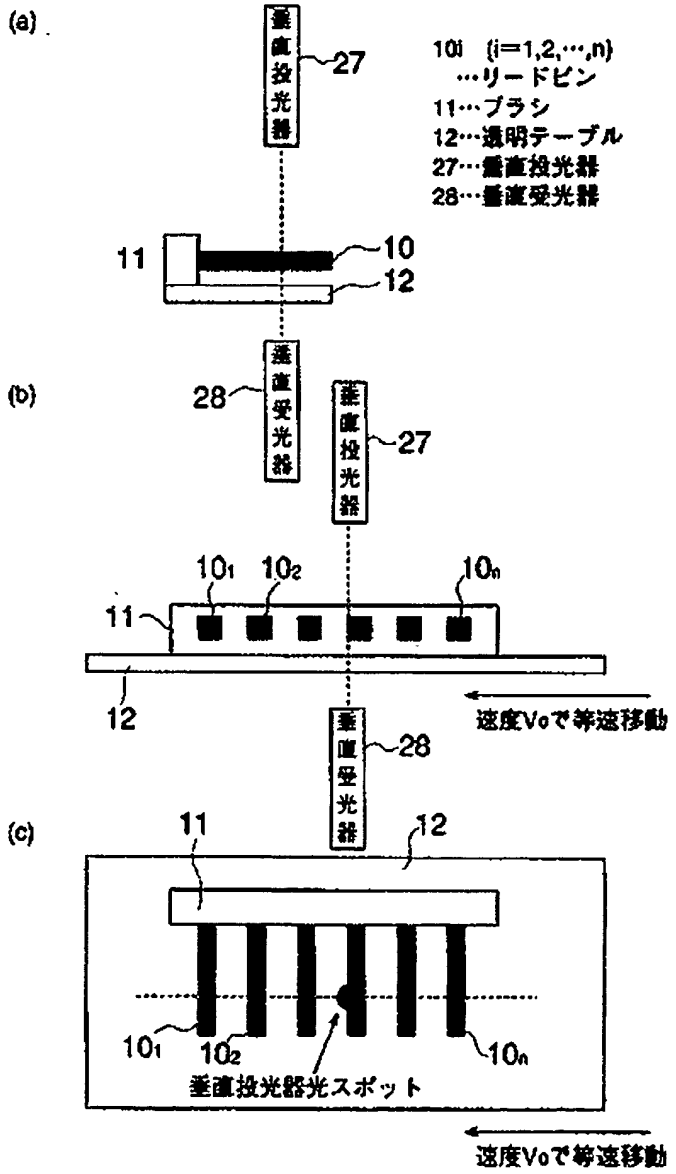
【図6】

図1のリードピン検査装置の第2の変形例における斜向受光器の出力信号を処理する回路構成を示すブロックダイアグラム



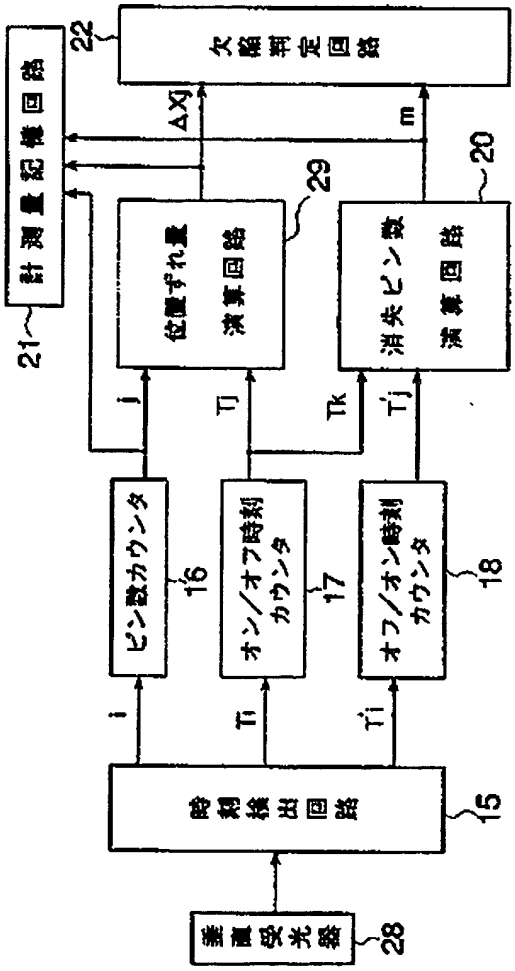
【図7】

本発明の第2の実施例による回転軸へ信号を伝達するブラシのリードピン検査装置を説明するための概略図



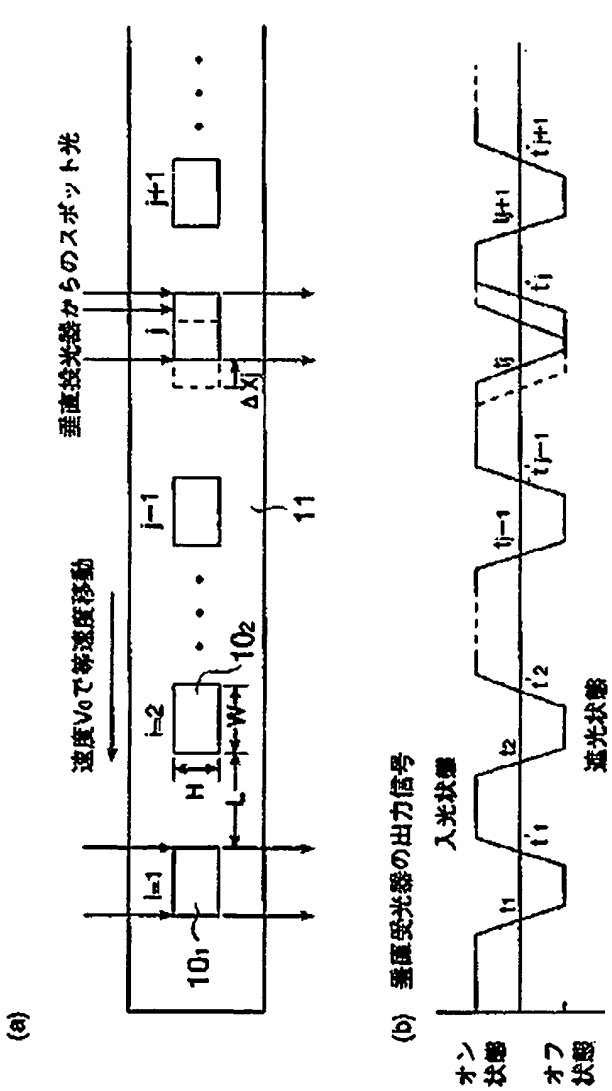
【図8】

図7のリードピン検査装置における垂直受光器の出力信号を処理する回路構成を示すブロックダイアグラム



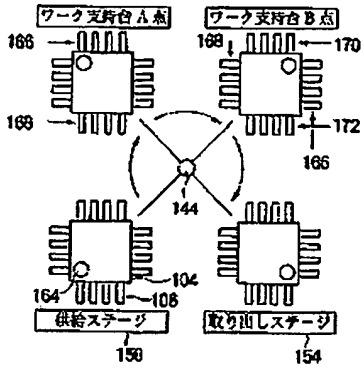
【図9】

図7のリードピン検査装置における
垂直受光器の出力信号のタイムチャート



【図24】

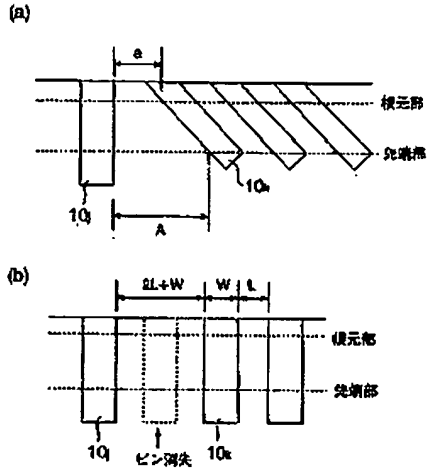
図21のリードピン検査装置における
ICパッケージの移動を説明するための概略図



104…ICパッケージ
106…リードピン
144…軸性
164…インデックスマーク
165…第1のリードピン列
168…第2のリードピン列
170…第3のリードピン列
172…第4のリードピン列

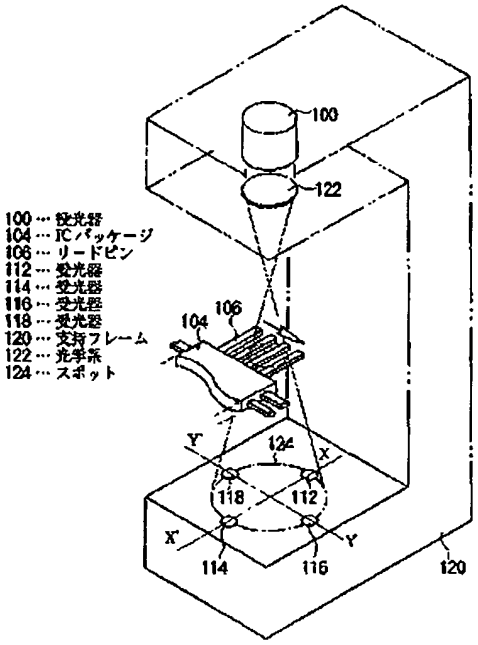
【図１０】

消失ピン数の計測する場合にスポット光はリードピンの根元部を照射することが望ましいことを説明するためのリードピンの拡大平面図



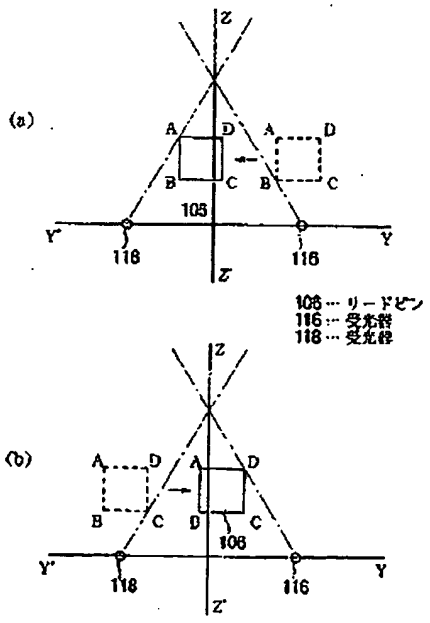
【図１６】

本発明の第４の実施例によるリードピン検査装置に用いる投受光器の動作を説明するための概略図



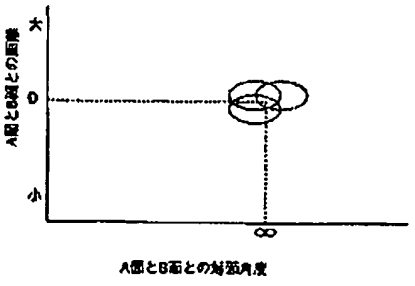
【図２０】

本発明の第５の実施例によるリードピン検査装置の原理説明図



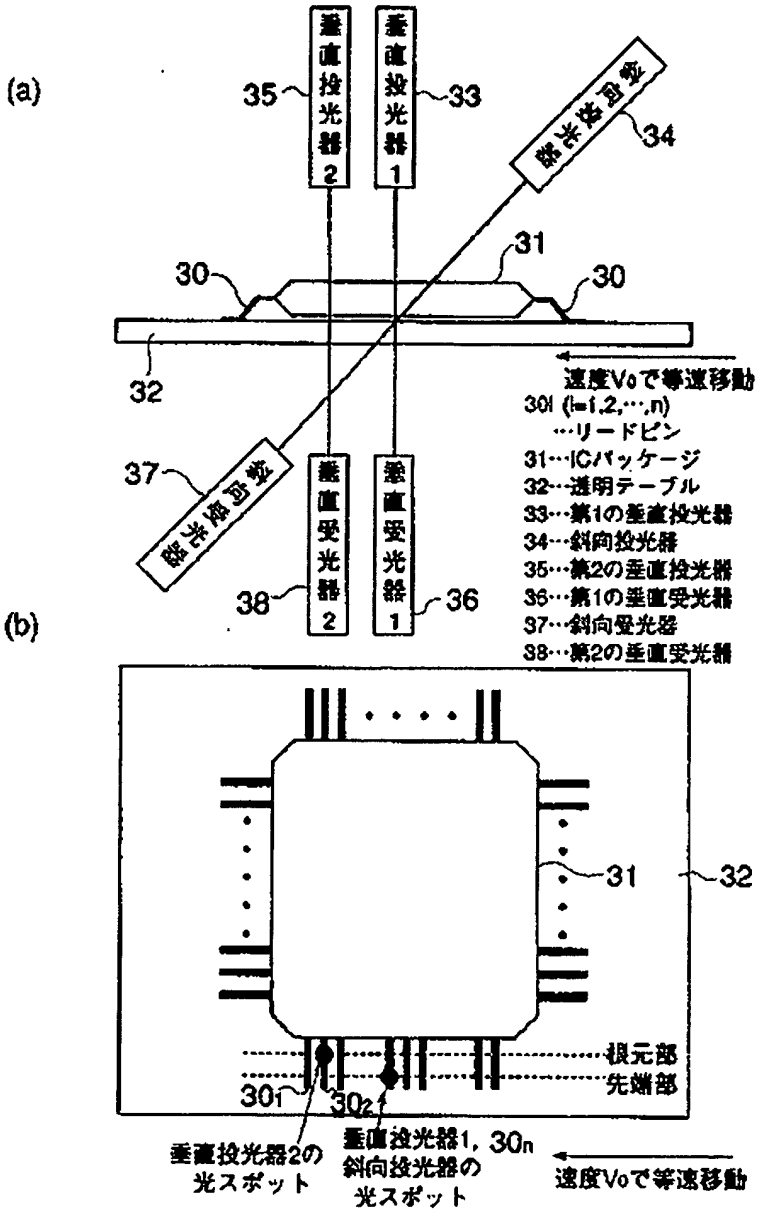
【図２７】

図26の位置制御装置の受光器の出力信号の検出図



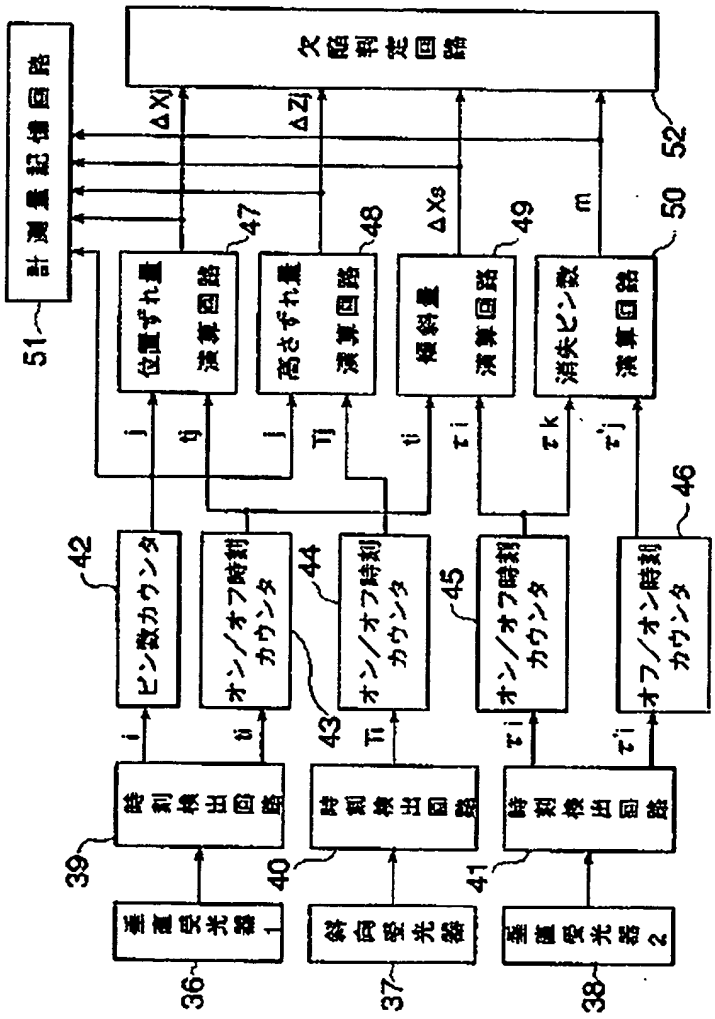
【図11】

本発明の第3の実施例によるICパッケージのリードピン検査装置を説明するための概略図



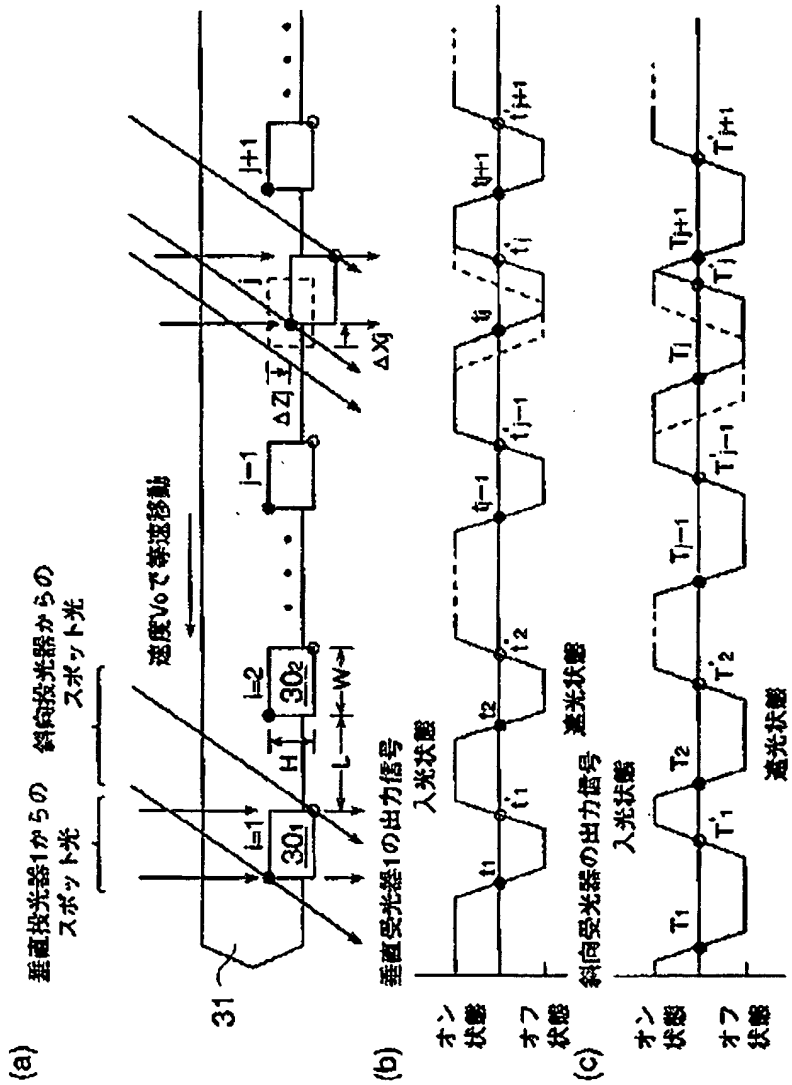
【図12】

図11のリードピン検査装置における垂直受光器及び斜向受光器の出力信号を処理する回路構成を示すブロックダイアグラム



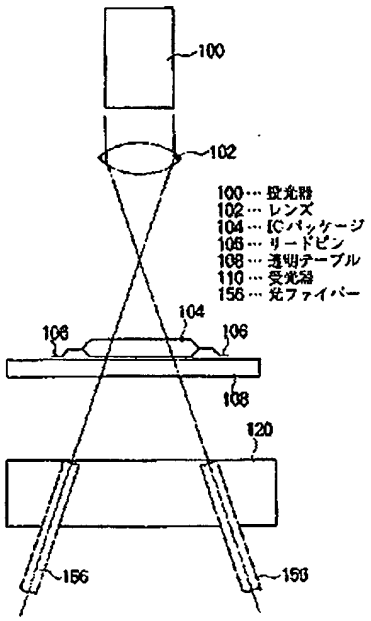
【図13】

図11のリードピン検査装置における垂直受光器及び斜向受光器の出力信号のタイムチャート



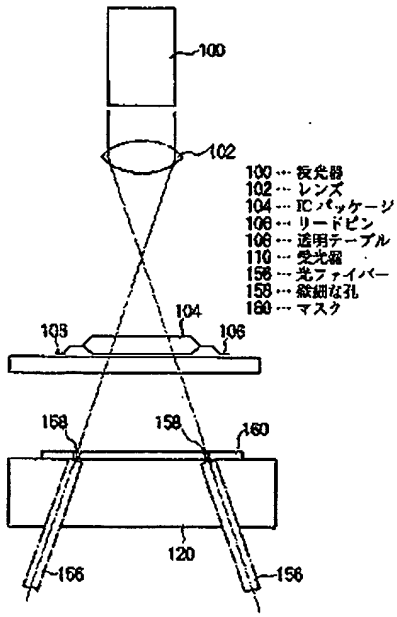
【図18】

図15の投受光器の変形例を説明するための図



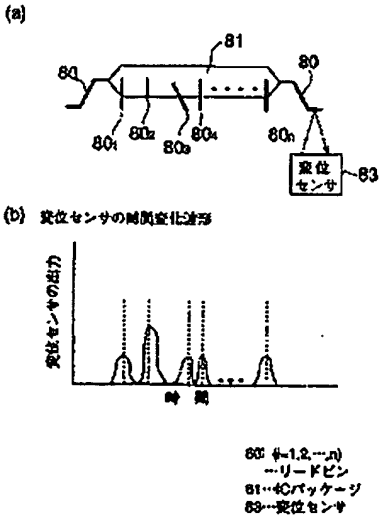
【図19】

図15の投受光器の変形例を説明するための図



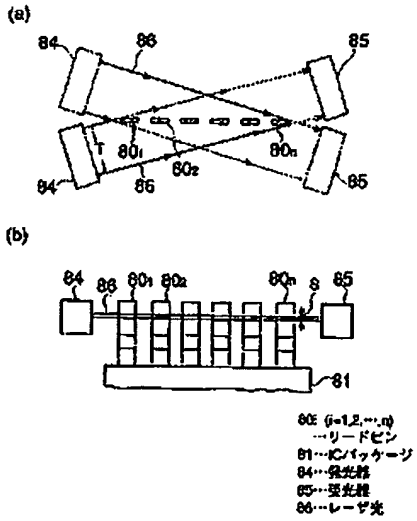
【図30】

従来のリードピン検査方法を説明するための概略図



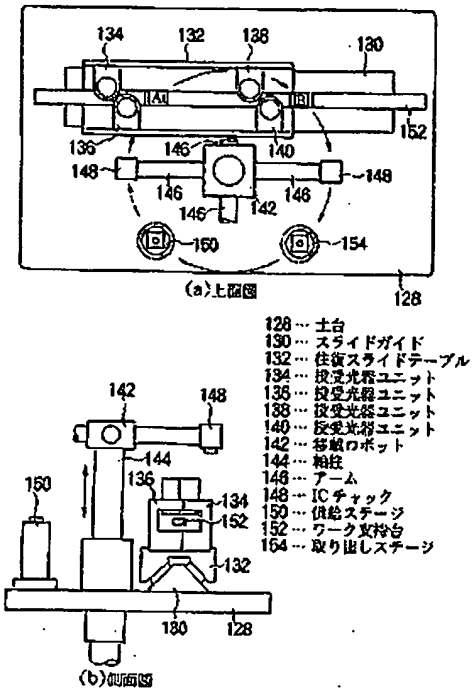
【図31】

従来のリードピン検査方法を説明するための概略図



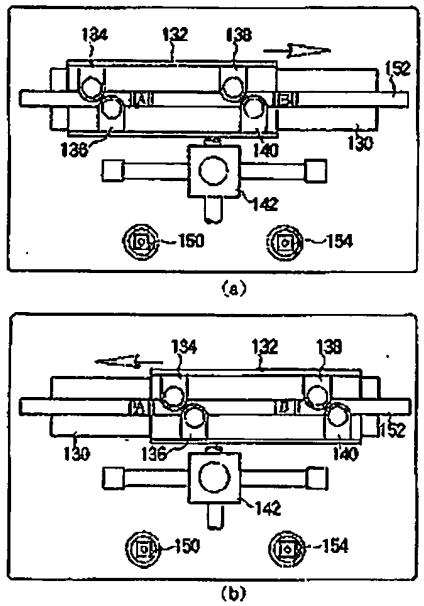
【図21】

本発明の第5の実施例によるリードピン検査装置を説明するための概略図



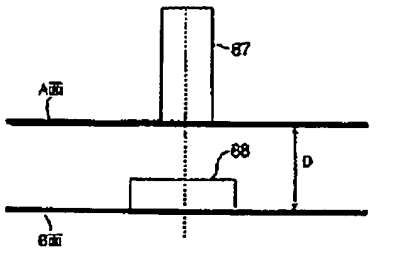
【図23】

図21のリードピン検査装置における往復スライドテーブルの動作を説明するための概略図



【図32】

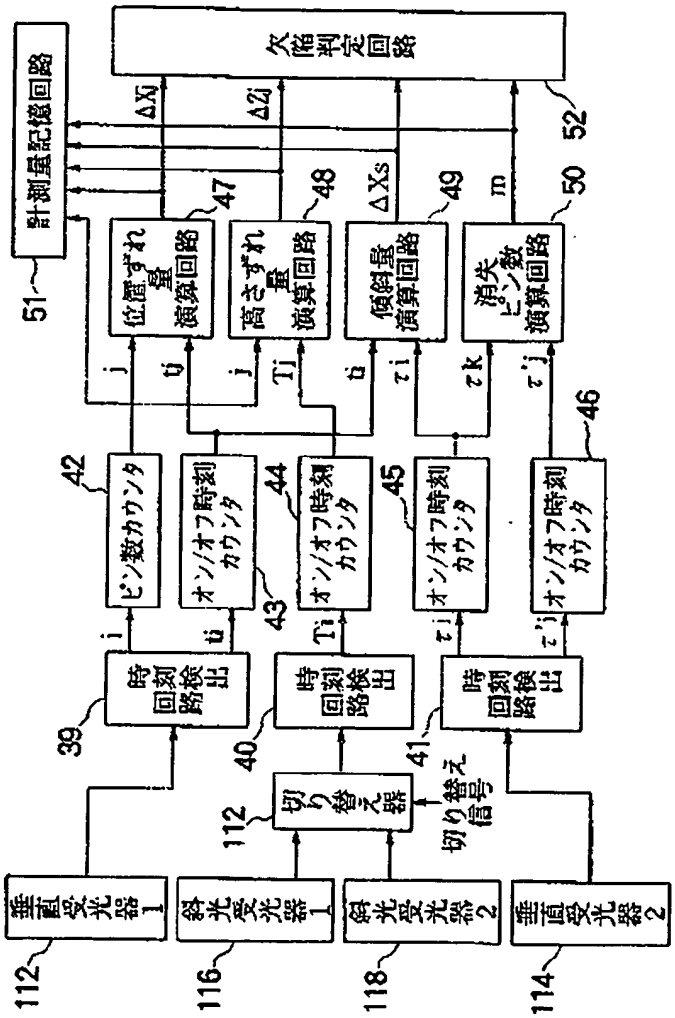
従来の位置制御方法を説明するための概略図



87…レーザ測長計
88…反射ミラー

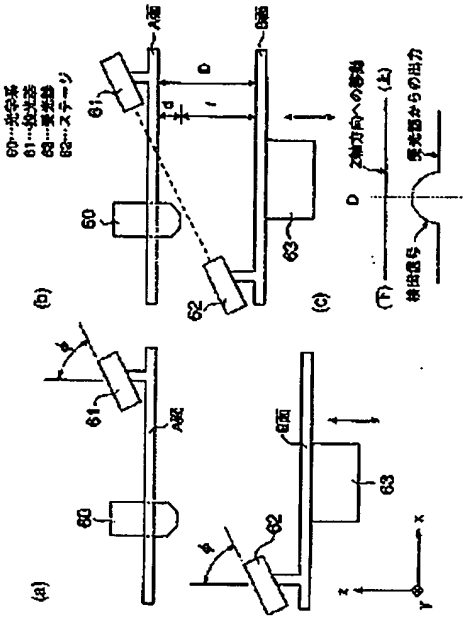
【図22】

図21のリードピン検査装置における垂直受光器及び斜向受光器の出力信号を処理する回路構成を示すブロックダイアグラム



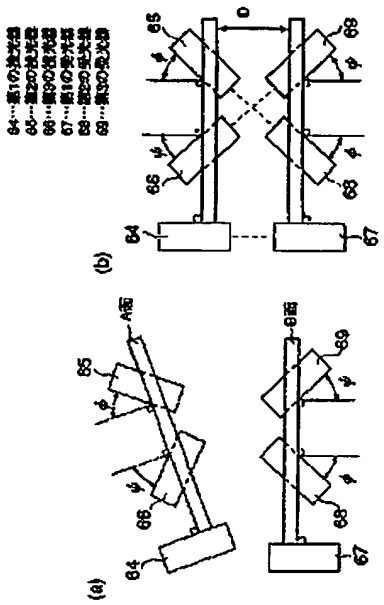
【図25】

本発明の第6の実施例による
位置制御装置を説明するための概略図



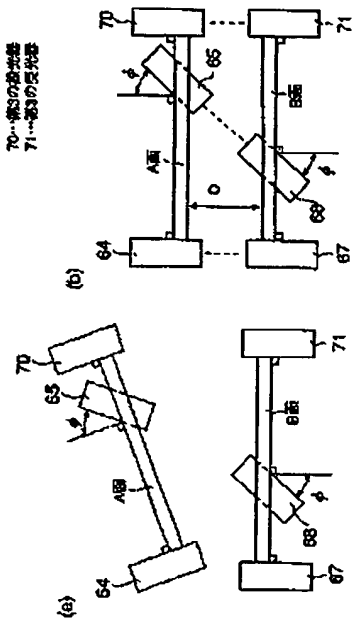
【図26】

本発明の第7の実施例による
位置制御装置を説明するための概略図



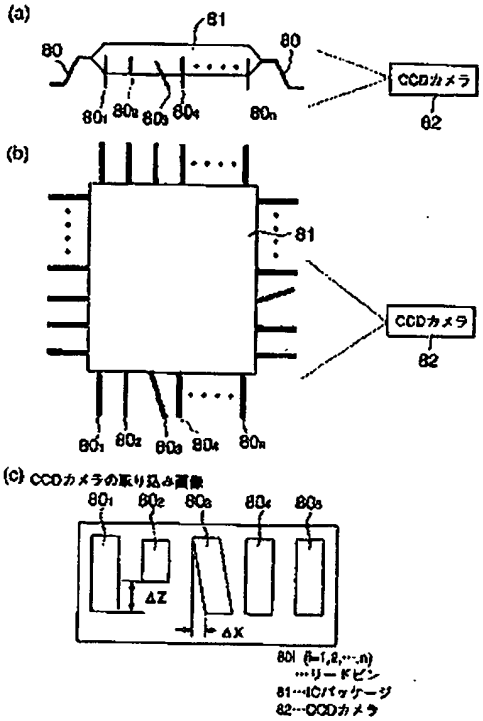
【図28】

図26の位置検知装置の変形例を説明するための概略図



【図29】

従来のリードピン検査方法を説明するための概略図



フロントページの続き

(72)発明者　荒谷　竹敏
神奈川県川崎市中原区上小田中1015番地
富士通オートメーション株式会社内

(72)発明者　新井　洗二
神奈川県川崎市中原区上小田中1015番地
富士通オートメーション式会社内

(72)発明者　神園　勝久
神奈川県川崎市中原区上小田中1015番地
富士通オートメーション式会社内

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 06-300541

(43)Date of publication of application : 28.10.1994

(51)Int.Cl. G01B 11/24
G01N 21/88

(21)Application number : 06-022889

(22)Date of filing : 21.02.1994

(71)Applicant : FUJITSU AUTOM LTD

(72)Inventor : KATO OSAMU
KIMURA TOSHIKATSU
SAITO HAJIME
ARAYA TAKETOSHI
ARAI KOJI
KAMISONO KATSUHISA

(30)Priority

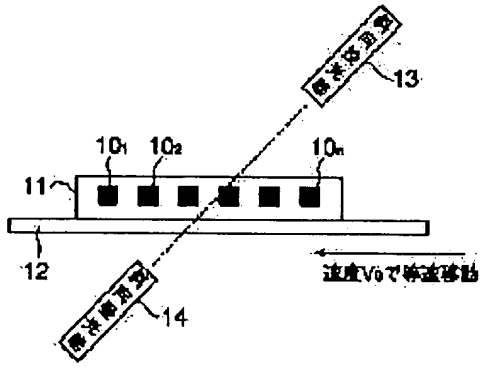
Priority number : 05 31491 Priority date : 22.02.1993 Priority country : JP

(54) LEAD PIN INSPECTION DEVICE AND POSITION CONTROL DEVICE

(57)Abstract:

PURPOSE: To provide a lead pin inspection device having the capability to inspect such a defect as lead pin dislocation, unequal pin height, pin disappearance and and collective pin inclination quickly, highly precisely, inexpensively and stably, and further provide a position control device having the capability to control a relative position between two opposite faces quickly, highly precisely, inexpensively and stably.

CONSTITUTION: A brush 11 with a plurality of lead pins 10i (i=1, 2..., n) led out, is moved at a constant speed along the array direction of the lead pins 10i with a uniform motion drive mechanism. Concurrently, light is irradiated to the tips of the lead pins 10i with an oblique projector 13a at the prescribed angle with the arrayed



plane thereof, and spot light passing between the lead pins 10i is received with an oblique light receiver 14. Furthermore, arithmetic operation is performed on the basis of the on/off time or the like of output signals from the light receiver 14, thereby measuring the extent of unequal lead pin height or the like, and making judgement about the existence of a defect in the lead pins 10i.

LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

* NOTICES *

CLAIMS

[Claim(s)]
[Claim 1] Lead pin test equipment which inspects two or more lead pins which are characterized by providing the following, and which set predetermined spacing and aligned The stage in which an inspected object with two or more lead pins is carried The light emitter and receiver which consists of an electric eye which receives the spot light from said projector which passed through between the projector which irradiates spot light with a predetermined include angle in the alignment side of two or more of said lead pins, and said two or more lead pins The driving means which moves said light emitter and receiver or said stage in the alignment direction of two or more of said lead pins A relative-speed-detector means to detect the relative passing speed of said light emitter and receiver by said driving means, and said stage, A time-of-day detection means to detect the shift time of day from an ON light condition to the protection-from-light condition of said electric eye, or the shift time of day from a protection-from-light condition to an ON light condition, An operation means to measure the amount of displacement from the normal location of each lead pin, or the number of deficits of a lead pin based on the shift time of day detected by the speed signal and said time-of-day detection means from said relative-speed-detector means, A defective judging means to judge the existence of the defect in said two or more lead pins based on the amount of displacement of each lead pin measured by said operation means, or the number of deficits of a lead pin
[Claim 2] The lead pin test equipment characterized by to replace with said driving means and said relative-speed-detector means, to have the uniform driving means which makes the uniform migration of said light emitter and receiver or said stage carry out in the alignment direction of two or more of said lead pins in lead pin test equipment according to claim 1, and for said operation means to measure the amount of displacement from the normal location of each lead pin, or the number of a lead pin of deficits based on the shift time of day detected by said time-of-day detection means.
[Claim 3] It replaces with said relative-speed-detector means in lead pin test equipment according to claim 1. It has a distance detection means to detect the distance to the pin to be examined by which said projector irradiates spot light from the predetermined criteria location of said two or more lead pins. Lead pin test equipment characterized by said operation means measuring the amount of displacement from the normal location of each lead pin, or the number of deficits of a lead pin based on the shift time of day detected by the distance signal and said time-of-day detection means from said distance detection means.
[Claim 4] Lead pin test equipment characterized by having an amount storage means of measurement to memorize the amount of displacement of each lead pin measured by said operation means, or the number of deficits of a lead pin in lead pin test equipment according to claim 1 to 3.
[Claim 5] Lead pin test equipment characterized by to install said projector in lead pin test equipment according to claim 1 to 4 so that the point of two or more of said lead pins may be aslant irradiated to the alignment side of two or more of said lead pins, and to measure the amount of height gaps and the number of disappearance pins of the amount of location gaps of each lead pin in said two or more lead pins and the number of disappearance pins, or each lead pin.

[Claim 6] Lead pin test equipment characterized by installing said projector in lead pin test equipment according to claim 1 to 4 so that root Motobe of two or more of said lead pins may be irradiated almost perpendicularly to the alignment side of two or more of said lead pins, and measuring the number of disappearance pins in said two or more lead pins.
[Claim 7] Lead pin test equipment according to claim 1 to 4 which is equipped with the following and characterized by measuring the amount of location gaps and the amount of height gaps of each lead pin in said two or more lead pins. Said 1st light emitter and receiver to which said light emitter and receiver irradiates almost perpendicularly the point of two or more of said lead pins to the alignment side of two or more of said lead pins The 2nd light emitter and receiver which irradiates aslant the point of two or more of said lead pins to the alignment side of two or more of said lead pins
[Claim 8] Lead pin test equipment according to claim 1 to 4 which is equipped with the following and characterized by measuring the amount of inclinations in which said two or more lead pins incline in the alignment direction collectively. Said 1st light emitter and receiver to which said light emitter and receiver irradiates almost perpendicularly the point of two or more of said lead pins to the alignment side of two or more of said lead pins The 2nd light emitter and receiver which irradiates almost perpendicularly root Motobe of two or more of said lead pins to the alignment side of two or more of said lead pins
[Claim 9] Lead pin test equipment according to claim 1 to 4 characterized by providing the following The projector with which said light emitter and receiver irradiates light in the alignment side of two or more of said lead pins Optical system which condenses the light emitted from said projector and irradiates the spot light of predetermined magnitude at a position Two or more electric-eye DOPIN test equipment which receives the light irradiated at an include angle which is arranged near the outer diameter of said spot light, is emitted from said projector, and is different to the alignment side of two or more of said lead pins [Claim 10] Lead pin test equipment characterized by preparing the linear member which transmits light to the front face of two or more of said electric eyes in lead pin test equipment according to claim 9, respectively.
[Claim 11] Lead pin test equipment characterized by preparing the mask with which the detailed hole which penetrates the light from said projector was formed in the front face of said electric eye in lead pin test equipment according to claim 9 [Claim 12] Lead pin test equipment characterized by preparing the mask with which the detailed hole which penetrates the light from said projector was formed in the front face of the linear member which transmits said light in lead pin test equipment according to claim 10 [Claim 13] Lead pin test equipment which is on the straight line of said spot light which intersects a right angle mostly at the core, and is characterized by the intensity of light emitted from said projector having arranged said two or more electric eyes in the almost equal location in lead pin test equipment according to claim 9 to 12 [Claim 14] The positional controller which controls the relative location of the 1st field and the 2nd field which are characterized by controlling said the 1st field and said 2nd field to a predetermined relative location by having the following, changing the relative location of said 1st and 2nd fields, and making in agreement the optical axis of said projector and said electric eye by said driving means, and which meet. The projector fixed to said 1st field The electric eye fixed so that an optical axis might be in agreement, when it was installed in said 2nd field and said the 1st field and said 2nd field became a predetermined relative location The driving means to which the location of said 1st field or said 2nd field is changed
[Claim 15] It is the driving means which moves said the 1st field or said 2nd field in the fixed direction so that said driving means may change spacing of said 1st and 2nd fields in a positional controller according to claim 14. The positional controller characterized by controlling the distance of the predetermined point of said 1st field, and the predetermined point of said 2nd field in a predetermined distance by changing a relative location with said 1st and 2nd fields, and making in agreement the optical axis of said projector and said electric eye by said driving means.
[Claim 16] The positional controller which are two fields where said the 1st field and said 2nd field meet in parallel in a positional controller according to claim 15, and is characterized by controlling the distance of said 1st field and said 2nd field in a predetermined distance by changing a relative location

with said 1st and 2nd fields, and making in agreement the optical axis of said projector and said electric eye by said driving means.
[Claim 17] It consists of at least three projectors with which said projector has an optical axis in the different direction in a positional controller according to claim 14. Said electric eye consists of at least three electric eyes corresponding to said at least three projectors. Said driving means is a driving means to which the distance and the include angle of said 1st field and said 2nd field to make are changed. By changing a relative location with said 1st and 2nd fields, and making the optical axis of said at least three projectors and said at least three electric eyes in agreement, respectively by said driving means The positional controller characterized by controlling the distance and the include angle of said 1st field and said 2nd field to make at a predetermined distance and a predetermined include angle.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the positional controller used for the automatic focus of the optical system of the lead pin test equipment which distinguishes the existence of the defect of a location gap of lead pins, such as components with two or more lead pins which were applied to lead pin test equipment and a positional controller, especially were pulled out from the side face, for example, the brush which transmits a signal to body of revolution, and an IC package, a height gap, disappearance, a collective inclination, etc., a microscope, etc., highly precise arrangement of a member, etc.
[0002]
[Description of the Prior Art] The lead pin inspection approach of the conventional IC package which uses a CCD camera is explained using drawing 29 . Here, the schematic diagram and drawing 29 (c) which show arrangement of a CCD camera when drawing 29 (a) and (b) look at an IC package from a side face and a top face are drawing showing the incorporation image by the CCD camera of the lead pin of an IC package.
[0003] CCD camera 82 is installed in the side of IC package 81 by which two or more lead pin 80i (i= 1, 2, --, n) is pulled out from the side face. And this lead pin 80i Light is hit to an alignment side from a projector (not shown), and it picturizes with CCD camera 82. Moreover, this CCD camera 82 is lead pin 80i of the incorporation image which is connected to the predetermined display (not shown) and was displayed on this display to IC package 81. It inspects.
[0004] For example, they are two or more lead pin 80i like lead pin 80i (i= 3). Like a gap (it is hereafter called "a location gap") in the alignment direction, and lead pin 80i (i= 2) When having produced the gap (it is hereafter called "a height gap") in a direction perpendicular to the alignment direction, It can ask for amount of location gaps deltaX, or amount of height gaps deltaZ from the incorporation image shown in drawing 29 (c) (refer to "the inspection technique of an IC package lead"; 1992 a magazine "electro mounting technology" and 5 (vol.8 No.5)).
[0005] Moreover, the lead pin inspection approach of the conventional IC package which uses a displacement sensor is explained using drawing 30 . Here, the schematic diagram showing arrangement of a displacement sensor when drawing 30 (a) looks at an IC package from a side face, and drawing 30 (b) are graphs which show the output wave of a displacement sensor. Two or more lead pin 80i currently pulled out from the side face of IC package 81 A displacement sensor 83 is installed caudad. And it is lead pin 80i about IC package 81. It is the lead pin 80i which moves, making uniform migration carry out in the alignment direction. A laser beam is irradiated from a displacement sensor 83 on the inferior surface of tongue of a point, the reflected light is again detected by the displacement sensor 83, and it is lead pin 80i of IC package 81 from the time amount change output wave. It inspects.
[0006] For example, when having produced the location gap and the height gap like lead pin 80i (2 i= 3), as shown in drawing 30 (b), in the output wave over time amount change of a displacement sensor 83, change arises at wave-like height or spacing between waves. Therefore, it can ask for a height gap

and a location gap of lead pin 80i (2 i= 3) from the variation rate of these height, or the variation rate of spacing (refer to "the inspection technique of an IC package lead"; 1992 a magazine "electro mounting technology" and 5 (vol.8 No.5)).
[0007] Moreover, the lead pin inspection approach of the conventional IC package which uses a photogenic organ and an electric eye is explained using drawing 31 . Here, the schematic diagram and drawing 31 (b) which show arrangement of a lead pin point when drawing 31 (a) looks at an IC package from a side face, a photogenic organ, and an electric eye are the flat-surface schematic diagram. Two or more lead pin 80i currently pulled out from the side face of IC package 81 1 set of photogenic organs 84 and an electric eye 85 are installed with a predetermined include angle to an alignment side. And lead pin 80i of plurality [laser beam / 86 / of the thickness dimension S irradiated from the photogenic organ 84, and the width-of-face dimension T] The light income which passes through between and is received by the electric eye 85 is memorized as an output value of an electric eye 85. Subsequently, it is made to move to the location which shows this 1 set of photogenic organs 84 and electric eye 85 with an alternate long and short dash line from the location shown as the continuous line in drawing, and the same actuation is repeated.
[0008] Thus, it is lead pin 80i of IC package 81 by comparing the output value of the memorized electric eye 85 with the case of the normal IC package which does not have a defect in a lead pin. It inspects. For example, since it differs from the output value acquired when it is an IC package with the normal output value of an electric eye 85 when a certain lead pin has produced the location gap and the height gap, the existence of a height gap of a lead pin or a location gap can be judged (refer to JP,1-260349,A).
[0009] Furthermore, the conventional position control approach which uses a laser length measuring machine is explained using drawing 32 . Here, drawing 32 is the side elevation of two fields which meet. When controlling the relative location of two fields which meet in parallel, the laser length measuring machine 87 is fixed to one Ath page, and the reflective mirror 88 is fixed to the Bth page of another side. And while discharging a laser beam from the laser length measuring machine 87 to the reflective mirror 88, moving the Ath page or the Bth page perpendicularly, the laser length measuring machine 87 detects the phase of a laser beam reflected by the reflective mirror 88. And the distance of the Ath page and the Bth page is measured from change of the phase of this detected laser beam. In this way, it is controllable in a location with the Ath page and a distance predetermined [Bth page].
[0010]
[Problem(s) to be Solved by the Invention] However, it sets to the lead pin inspection approach of the IC package which uses the above-mentioned conventional CCD camera, and is lead pin of one side 80i of IC package 81. It is difficult to store all in the visual field of CCD camera 82, and to inspect by one image pick-up, considering the resolution of CCD camera 82. Therefore, in order to obtain the resolving power more than fixed, multiple-times migration of IC package 81 or CCD camera 82 must be carried out, and the defect in which inspection time amount increases arises. In addition, although it is possible to aim at compaction of inspection time amount by installing two or more CCD cameras 82, the defect in which complicated-izing and a cost rise of test equipment are caused arises in this case.
[0011] Moreover, it sets to the lead pin inspection approach of the IC package which uses the above-mentioned conventional displacement sensor, and is lead pin 80i. In order to detect the laser beam reflected on the inferior surface of tongue by the displacement sensor 83, it is lead pin 80i. If a surface state at the bottom is caused how, the reflected light is changed and there is a defect in which the case where it becomes difficult for it to be stabilized and to detect the variation rate of height and the variation rate of spacing arises.
[0012] Moreover, lead pin 80i of IC package 81 Since width of face is usually 100-200 micrometers, it is required that it should have the minute laser spot of 10 micrometerphi extent, and should have high-speed responsibility as engine performance of a displacement sensor 83. Therefore, if it is going to guarantee the inspection precision while causing the fall of inspection precision, if it is not such a highly efficient displacement sensor 83, the problem of causing a cost rise will arise.
[0013] Moreover, it sets to the lead pin inspection approach of the IC package which uses the photogenic organ and the electric eye of the above-mentioned former, and they are two or more lead pin

80i. In order to measure with the case of a normal IC package the whole quantity of light which passes through between, they are two or more lead pin 80i. Even if it can judge the existence of the height gap which can be set, or a location gap, the amount of height gaps and the amount of location gaps of lead pin 80 the very thing which has a defect are immeasurable. Therefore, it has the defect in which the inspection based on the size judging of the amount of gaps is impossible, and highly precise inspection cannot be performed. Moreover, which lead pin 80i Whether it being easy to be generated by what kind of defect and analysis are also impossible, and the improvement of the approach of dealing with it based on the analysis, the storage approach, etc. cannot be aimed at, either.

[0014] Furthermore, in the position control approach which uses the above-mentioned conventional laser length measuring machine, since the laser length measuring machine 87 is expensive, there is a defect in which it becomes a cost rise. Moreover, in order that the reflective mirror 88 may be installed in sense in which a reflective laser beam carries out incidence to the laser length measuring machine 87 correctly and may hold the front face to the laser beam wavelength lambda to the mirror plane of lambda / precision of 2 - lambda/4, it also has the problem that the installation and management take great trouble, in actual use.

[0015] Then, this invention solves the technical problem of such a conventional technique, and aims at offering the positional controller which are a high speed, high degree of accuracy, and a low price, and controls stably the lead pin test equipment which is a high speed, high degree of accuracy, and a low price, and inspects stably the defect of a location gap of a lead pin, a height gap, disappearance, a collective inclination, etc., and the relative location of two fields which meets.

[0016]

[Means for Solving the Problem] In the lead pin test equipment which inspects two or more lead pins which the above-mentioned technical problem set predetermined spacing, and aligned The light emitter and receiver which consists of an electric eye which receives the spot light from said projector which passed through between the stage in which an inspected object with two or more lead pins is carried, the projector which irradiates spot light with a predetermined include angle in the alignment side of two or more of said lead pins, and said two or more lead pins, The driving means which moves said light emitter and receiver or said stage in the alignment direction of two or more of said lead pins, A relative-speed-detector means to detect the relative passing speed of said light emitter and receiver by said driving means, and said stage, A time-of-day detection means to detect the shift time of day from an ON light condition to the protection-from-light condition of said electric eye, or the shift time of day from a protection-from-light condition to an ON light condition, An operation means to measure the amount of displacement from the normal location of each lead pin, or the number of deficits of a lead pin based on the shift time of day detected by the speed signal and said time-of-day detection means from said relative-speed-detector means, It is attained by the lead pin test equipment characterized by having a defective judging means to judge the existence of the defect in said two or more lead pins, based on the amount of displacement of each lead pin measured by said operation means, or the number of deficits of a lead pin.

[0017] Moreover, it replaces with said driving means and said relative-speed-detector means in the above-mentioned lead pin test equipment. It has the uniform driving means which makes the uniform migration of said light emitter and receiver or said stage carry out in the alignment direction of two or more of said lead pins. It is attained by the lead pin test equipment characterized by said operation means measuring the amount of displacement from the normal location of each lead pin, or the number of deficits of a lead pin based on the shift time of day detected by said time-of-day detection means.

[0018] Moreover, it replaces with said relative-speed-detector means in the above-mentioned lead pin test equipment. It has a distance detection means to detect the distance to the pin to be examined by which said projector irradiates spot light from the predetermined criteria location of said two or more lead pins. It is attained by the lead pin test equipment characterized by said operation means measuring the amount of displacement from the normal location of each lead pin, or the number of deficits of a lead pin based on the shift time of day detected by the distance signal and said time-of-day detection means from said distance detection means.

[0019] Moreover, it is attained in the above-mentioned lead pin test equipment by the lead pin test equipment characterized by having an amount storage means of measurement to memorize the amount of displacement of each lead pin measured by said operation means, or the number of deficits of a lead pin. Moreover, said projector is installed so that the point of two or more of said lead pins may be aslant irradiated to the alignment side of two or more of said lead pins, and it is attained in the above-mentioned lead pin test equipment by the lead pin test equipment characterized by to measure the amount of height gaps and the number of disappearance pins of the amount of location gaps of each lead pin in two or more of said lead pins and the number of disappearance pins, or each lead pin.
[0020] Moreover, in the above-mentioned lead pin test equipment, said projector is installed so that root Motobe of two or more of said lead pins may be irradiated almost perpendicularly to the alignment side of two or more of said lead pins, and it is attained by the lead pin test equipment characterized by measuring the number of disappearance pins in said two or more lead pins. Moreover, said 1st light emitter and receiver to which said light emitter and receiver irradiates almost perpendicularly the point of two or more of said lead pins to the alignment side of two or more of said lead pins in the above-mentioned lead pin test equipment, It has the 2nd light emitter and receiver which irradiates aslant the point of two or more of said lead pins to the alignment side of two or more of said lead pins, and is attained by the lead pin test equipment characterized by measuring the amount of location gaps and the amount of height gaps of each lead pin in said two or more lead pins.
[0021] Moreover, said 1st light emitter and receiver to which said light emitter and receiver irradiates almost perpendicularly the point of two or more of said lead pins to the alignment side of two or more of said lead pins in the above-mentioned lead pin test equipment, It has the 2nd light emitter and receiver which irradiates almost perpendicularly root Motobe of two or more of said lead pins to the alignment side of two or more of said lead pins, and is attained by the lead pin test equipment characterized by measuring the amount of inclinations in which said two or more lead pins incline in the alignment direction collectively.
[0022] Moreover, the projector with which said light emitter and receiver irradiates light in the above-mentioned lead pin test equipment in the alignment side of two or more of said lead pins, The optical system which condenses the light emitted from said projector and irradiates the spot light of predetermined magnitude at a position, It is arranged near the outer diameter of said spot light, is emitted from said projector, and is attained by the lead pin test equipment characterized by having two or more electric eyes which receive the light irradiated at a different include angle to the alignment side of two or more of said lead pins.
[0023] Moreover, it is attained in the above-mentioned lead pin test equipment by the lead pin test equipment characterized by preparing the linear member which transmits light to the front face of two or more of said electric eyes, respectively. Moreover, it is attained in the above-mentioned lead pin test equipment by the lead pin test equipment characterized by preparing the mask with which the detailed hole which penetrates the light from said projector was formed in the front face of said electric eye.
[0024] Moreover, it is attained in the above-mentioned lead pin test equipment by the lead pin test equipment characterized by preparing the mask with which the detailed hole which penetrates the light from said projector was formed in the front face of the linear member which transmits said light. Moreover, in the above-mentioned lead pin test equipment, it is on the straight line of said spot light which intersects a right angle mostly at the core, and the intensity of light emitted from said projector is attained by the lead pin test equipment characterized by having arranged said two or more electric eyes in the almost equal location.
[0025] Furthermore, it sets to the positional controller which controls the relative location of the 1st field and the 2nd field which meet. The projector fixed to said 1st field, and the electric eye fixed so that an optical axis might be in agreement when it was installed in said 2nd field and said the 1st field and said 2nd field became a predetermined relative location, By having the driving means to which the location of said 1st field or said 2nd field is changed, changing the relative location of said 1st and 2nd fields, and making in agreement the optical axis of said projector and said electric eye by said driving means It is attained by the positional controller characterized by controlling said the 1st field and said 2nd field to

a predetermined relative location.
[0026] Moreover, it is the driving means which moves said the 1st field or said 2nd field in the fixed direction so that said driving means may change spacing of said 1st and 2nd fields in the above-mentioned positional controller. By changing a relative location with said 1st and 2nd fields, and making in agreement the optical axis of said projector and said electric eye by said driving means It is attained by the positional controller characterized by controlling the distance of the predetermined point of said 1st field, and the predetermined point of said 2nd field in a predetermined distance.
[0027] Moreover, they are two fields where said the 1st field and said 2nd field meet in parallel in the above-mentioned positional controller. It is attained by the positional controller characterized by controlling the distance of said 1st field and said 2nd field in a predetermined distance by changing a relative location with said 1st and 2nd fields, and making in agreement the optical axis of said projector and said electric eye by said driving means.
[0028] Moreover, it consists of at least three projectors with which said projector has an optical axis in the different direction in the above-mentioned positional controller. Said electric eye consists of at least three electric eyes corresponding to said at least three projectors. Said driving means is a driving means to which the distance and the include angle of said 1st field and said 2nd field to make are changed. By changing a relative location with said 1st and 2nd fields, and making the optical axis of said at least three projectors and said at least three electric eyes in agreement, respectively by said driving means It is attained by the positional controller characterized by controlling the distance and the include angle of said 1st field and said 2nd field to make at a predetermined distance and a predetermined include angle.
[0029]
[Function] This invention moving the stage in which the light emitter and receiver or the inspected object was carried in the alignment direction of two or more lead pins By irradiating spot light with a predetermined include angle in the alignment side of two or more lead pins by ******, and receiving the spot light which passed through between the lead pin by the electric eye The shift time of day from an ON light condition to the protection-from-light condition of an electric eye or the shift time of day from a protection-from-light condition to an ON light condition is detectable.
[0030] In two or more lead pins, when a certain lead pin is displacing from the normal location or is missing, it differs from shift time of day when the shift time of day from an ON light condition to the protection-from-light condition of an electric eye or the shift time of day from a protection-from-light condition to an ON light condition is normal. For this reason, the amount of displacement from the normal location of each lead pin or the number of deficits of a lead pin is correctly [easily and] measurable by detecting that variation and performing a predetermined operation. Therefore, based on these amounts of displacement, or the number of deficits, it becomes possible to judge the existence of the defect in two or more lead pins.
[0031]
[Example] Hereafter, it explains based on the example illustrating this invention. Drawing 1 is a schematic diagram for explaining the lead pin test equipment of the brush which transmits a signal to the revolving shaft by the 1st example of this invention, and shows arrangement of 1 set of light emitters and receivers when seeing a subject-of-examination slack brush from a transverse plane, a side face, and a top face to each drawing 1 (a), (b), and (c), respectively. Moreover, drawing 2 is a block flow diagram which shows the circuitry which processes the output signal of an electric eye.
[0032] The brush 11 with which two or more lead pin 10i (i= 1, 2, --, n) is pulled out from the side face is carried on the transparence table 12 which penetrates light. Moreover, this transparence table 12 is lead pin 10i by the uniform driver (not shown). Uniform migration is carried out in the alignment direction. The **** projector 13 using semiconductor laser to irradiate is installed above this transparence table 12, and it is lead pin 10i. Spot light is irradiated with the predetermined include angle phi to an alignment side. Moreover, under the transparence table 12, the **** projector 13 is countered, for example, the **** electric eye 14 using a pin photodiode is installed, and it is lead pin 10i. The spot light from the **** projector 13 which passed through between is received. In this way, lead pin 10i 1 set of light emitters and receivers which face across an alignment side in between are arranged.

[0033] moreover, to this **** electric eye 14 The spot light from the **** projector 13 is lead pin 10i. The condition (ON light condition) which is passing through and carrying out ON light of the between to spot light is lead pin 10i. Time of day which shifts to an ON light condition from the time of day which shifts to the condition (protection-from-light condition) of being shaded, and a protection-from-light condition, That is, the time-of-day detector 15 which detects ON / off time of day Ti of the output signal of the **** electric eye 14, and (i= 1, 2, --, n) OFF/ON time-of-day T'i (i= 1, 2, --, n) is connected.

[0034] Moreover, in this time-of-day detector 15, it is lead pin 10i. The number counter 16 of pins, and ON / off time of day Ti which counts a number The ON / off time-of-day counter 17 to count, and OFF/ON time-of-day T'i OFF/ON time-of-day counter 18 to count is connected, respectively. Moreover, the amount arithmetic circuit 19 of height gaps which calculates amount of height gaps deltaZ is connected to the number counter 16 of pins, and the ON / off time-of-day counter 17, and the number arithmetic circuit 20 of disappearance pins which calculates disappearance pin several m of a lead pin is connected to ON / off time-of-day counter 17, and OFF/ON time-of-day counter 18.

[0035] Furthermore, while the number counter 16 of pins, the amount arithmetic circuit 19 of height gaps, and the number arithmetic circuit 20 of disappearance pins are connected to the amount store circuit 21 of measurement, the amount arithmetic circuit 19 of these height gaps and the number arithmetic circuit 20 of disappearance pins are connected to the defective judging circuit 22 which finally distinguishes the existence of the defect of a lead pin. Next, it explains using the timing diagram of the output signal of the electric eye which shows the case where amount of height gaps deltaZ of a lead pin is measured using the lead pin test equipment by the 1st example to the block flow diagram and drawing 3 of drawing 2 .

[0036] Now, as shown in drawing 3 , it is each lead pin 10i of a subject-of-examination slack brush. W and its thickness are set to H and spacing which aligned normally is set to L for width of face. moreover, j-th lead pin 10j Two or more lead pin 10i a direction perpendicular to an alignment side -- facing down -- deltaZj only -- suppose that it has shifted. However, lead pin 10i There shall be no location gap in the alignment direction.

[0037] First, they are two or more lead pin 10i by the uniform driver (not shown) about this transparence table 12 after carrying a brush 11 on the transparence table 12. Rates [direction / alignment] Vo It is made to move. And spot light is irradiated from the **** projector 13 at coincidence. At this time, the spot light from the **** projector 13 is lead pin 10i. It is desirable to irradiate a point. It is because amount of height gaps deltaZ becomes large, so the direction of a point becomes easily [measurement] and exact. moreover, the spot light from the **** projector 13 -- lead pin 10i the include angle made to an alignment side, and the so-called illuminating angle phi -- lead pin 10i the amount of the maximum gaps to the height direction from an alignment side -- deltaZMAX ** -- if it carries out pi / 2> phi>tan -1 {(H+2 and deltaZMAX) /L} -- (1)

It is necessary to set up so that it may be satisfied. If it is because it will irradiate perpendicularly from the **** projector 13 and it becomes impossible to measure amount of height gaps deltaZ, when the illuminating angle phi becomes pi/2 and the illuminating angle phi becomes smaller than the range of the above-mentioned (1) formula, spot light is lead pin 10i. It is because the case where it becomes impossible to pass through between arises. However, it is more desirable for the smaller possible one, i.e., spot light, to irradiate from across within the limits of the above-mentioned (1) formula, when measuring amount of height gaps deltaZ.

[0038] In this way, the spot light from the **** projector 13 is lead pin 10i. While irradiating a point, it is lead pin 10i. The spot light which passed through between is received by the **** electric eye 14. And lead pin 10from ON light condition to **** electric eye 14 of spot light i Time of day which shifts to a protection-from-light condition according to the upper left hand corner (- shows in drawing 3 (a)), Namely, lead pin 10from ON/OFF time-of-day [of an output signal] Ti, and (- shows in drawing 3 (b)) protection-from-light condition i Time of day which shifts to an ON light condition according to a lower right angle (O shows in drawing 3 (a)), That is, the time-of-day detector 15 detects ON/OFF time-of-day T'i (O shows in drawing 3 (b)) of an output signal, and it is j-th lead pin 10j. ON/OFF time of day Tj to

depend It counts with ON/OFF time-of-day counter 17.
[0039] Subsequently, several j, and ON / off time of day Tj from ON / off time-of-day counter 17 of the lead pin made into the object from the number counter 16 of pins in the amount arithmetic circuit 19 of height gaps It is based and is amount of height gaps deltaZj. It calculates. Namely, j-th lead pin 10j ON / off time of day Tj to depend Tj ={(W+L)x(j-1)+deltaZj/tan phi}/Vo+T1 -- (2)
Next door, therefore j-th lead pin 10j Amount of height gaps deltaZj deltaZj ={(Tj-T1) xVo-(W+L)x(j-1)} xtan phi -- (3)
It becomes.
[0040] Next, it explains using the timing diagram of the output signal of the electric eye which shows the case where disappearance pin several m of a lead pin is measured using the lead pin test equipment by the 1st example to the block flow diagram and drawing 4 of drawing 2 . Now, as shown in drawing 4 , it is j-th lead pin 10j. Suppose that m lead pins have disappeared from the degree.
[0041] Like the case where amount of height gaps deltaZ is measured, the subject-of-examination slack brush 11 is carried on the transparence table 12, and it is lead pin 10i by the uniform driver. Rates [direction / alignment] Vo Spot light is irradiated from the **** projector 13, making it move. And lead pin 10i The spot light which passed through between is received by the **** electric eye 14, and they are ON / off time of day Ti of the output signal of the **** electric eye 14. And OFF/ON time-of-day T'i The time-of-day detector 15 detects.
[0042] Subsequently, j-th lead pin 10j detected by the time-of-day detector 15 OFF/ON time-of-day T'j While counting with OFF/ON time-of-day counter 18, it is lead pin 10j. The following lead pin 10k The ON / off time of day Tk to depend It counts with ON / off time-of-day counter 17. Subsequently, it sets to the number arithmetic circuit 20 of disappearance pins, and is OFF/ON time-of-day T'j from OFF/ON time-of-day counter 18, and the ON / off time-of-day counter 17. And ON / off time of day Tk It is based and disappearance pin several m is measured.
[0043] namely, -- if m disappearance pins exist -- j-th lead pin 10j OFF/ON time-of-day T'j from -- the following lead pin 10k The ON / off time of day Tk to depend up to -- deltabetween close light-hours T to the **** electric eye 14 -- long -- becoming -- deltaT=Tk-T'j = {(W+L) xm+L}/Vo -- (4)
It becomes. Therefore, disappearance pin several m m=(deltaTxVo-L)/(W+L)
= {(Tk-T'j) xVo-L} /(W+L) -- (5)
It becomes.
[0044] Amount of height gaps deltaZj of the lead pin measured as mentioned above And disappearance pin several m, while memorizing as data in the amount store circuit 21 of measurement, in the defective judging circuit 22, the final distinction about the defect of a lead pin based on such total quantity is made. Thus, it is lead pin 10i by the uniform driver about the brush 11 which transmits a signal to a revolving shaft according to the 1st example. It is a rate Vo to the alignment direction. Carrying out uniform migration It is lead pin 10i by the **** projector 13. A point is irradiated with phi to the alignment side whenever [predetermined acute-angle]. Lead pin 10i The spot light which passed through between is received by the **** electric eye 14. ON / off time of day Ti of the output signal of the **** electric eye 14 And OFF/ON time-of-day T'i The time-of-day detector 15 detects, respectively. Amount of height gaps deltaZ of a lead pin and disappearance pin several m are measurable by calculating based on (3) and (5) types in the amount arithmetic circuit 19 of height gaps, and the number arithmetic circuit 20 of disappearance pins. therefore, the defective judging circuit 22 -- amount of height gaps deltaZj of these lead pins and a ****** [that the target lead pin based on disappearance pin several m is a defect] -- judging -- two or more lead pin 10i Finally the existence of the defect of the lead pin which can be set can be distinguished.
[0045] At this time, it is amount of height gaps deltaZj of a lead pin. It reaches and disappearance pin several m is ON/OFF time of day Ti of the output signal of the **** electric eye 14. And OFF/ON time-of-day T'i Since it is measurable only with the based characteristic quantity, it is possible after conveyance migration of the brush 11 for inspection to obtain a judgment result at a high speed for a short time. moreover, amount of height gaps deltaZj of these lead pins and disappearance pin several m counting -- since an amount is memorized as data in the amount store circuit 21 of measurement, it

becomes possible [presenting the analysis for improving a manufacture process, the handling approach, etc.].

[0046] Moreover, since it is possible to use comparatively cheap things, such as semiconductor laser and a pin photodiode, low-pricing is realizable for the **** projector 13 and the **** electric eye 14 also in cost. Moreover, since it is the optical system of a transparency mold, the light emitter and receiver which consists of a **** projector 13 and a **** electric eye 14 is lead pin 10i. The output signal stabilized from the **** electric eye 14 can be acquired without being dependent on a surface state. Therefore, lead pin 10i Measurement highly precise about the amount of displacement or the amount of deficits is attained, and the final distinction about the defect of a lead pin also becomes what has high dependability.

[0047] Moreover, it becomes possible by attaching a predetermined lens system, for example to semiconductor laser, and extracting the spot light of the **** projector 13 more minutely, and sampling the output signal of the **** electric eye 14 still at high speed to attain high-speed measurement with still higher resolution, therefore to raise highly-precise-izing in inspection, and high-speed-ization. In addition, it is lead pin 10i about the transparence table 12 which carried the brush 11 by the uniform driver in the 1st example of the above. Although the case where uniform migration was carried out was explained in the alignment direction This uniform migration is lead pin 10i. Since it is relative relation with 1 set of light emitters and receivers which consist of a **** projector 13 and a **** electric eye 14, it is lead pin 10i. Instead of moving the direction, uniform migration of the light emitter and receiver may be carried out.

[0048] Moreover, lead pin 10i of a brush 11 Since it is very small, width of face W and spacing L may be difficult to perform strict uniform migration. In such a case, it is lead pin 10i about the transparence table 12 instead of a uniform driver. What is necessary is just to install the relative-speed-detector sensor which detects the driver which makes it move in the alignment direction, and the passing speed by the driver.

[0049] In this case, as the block flow diagram which shows the circuitry which processes the output signal of an electric eye is shown in drawing 5 , the relative-speed-detector sensor 23 will join the block flow diagram of drawing 2 , and the speed signal V in each time of day will be sent to the amount arithmetic circuit 19 of height gaps, and the number arithmetic circuit 20 of disappearance pins from this relative-speed-detector sensor 23. Therefore, it is [0050] instead of xVo [in / on the amount arithmetic circuit 19 of height gaps, and / (3) types (Tj-T1)].

[Equation 1]

$$\int_{T1}^{Tj} V \cdot dT$$

A ******** operation is made and it is j-th lead pin 10j. Amount of height gaps deltaZj [0051]

[Equation 2]

$$\Delta Zj = \left\{ \int_{T1}^{Tj} V \cdot dT - (W+L) \times (i-1) \right\} \times \tan \phi \quad \cdots (6)$$

It becomes. Moreover, it is [0052] instead of xVo [in / on the number arithmetic circuit 20 of disappearance pins, and / (5) types (Tk-T'j)].

[Equation 3]

$$\int_{T'j}^{Tk} V \cdot dT$$

A ******** operation is made and disappearance pin several m is [0053].
[Equation 4]

$$m = \left(\int_{T'j}^{Tk} V \cdot dT - L \right) \Big/ (W + L) \qquad \cdots (7)$$

It becomes. furthermore, the thing for which a distance detection means is used instead of being based on the above rate information since both xVo in (3) and (5) types (Tj-T1) and xVo are the things showing a variation rate -- lead pin 10from a certain criteria location i up to -- lead pin 10i The distance of the alignment direction may be found.
[0054] In this case, the block flow diagram which shows the circuitry which processes the output signal of an electric eye As shown in drawing 6 , the distance detection sensor 24 joins the block flow diagram of drawing 2 . Instead of ON / off time-of-day counter 17, and OFF/ON time-of-day counter 18 ON / off time of day Ti Lead pin 10from predetermined criteria location i which can be set Distance Li to a left lateral the time of the ON/OFF to count -- a distance counter 25 and OFF/ON time-of-day T'i Lead pin 10from predetermined criteria location i which can be set Distance L'i to a right lateral At the time of the OFF/ON to count, it connects with the time-of-day detector 15 and the distance detection sensor 24, respectively, and a distance counter 26 is installed. Therefore, it sets to the amount arithmetic circuit 19 of height gaps. j-th lead pin 10j sent from a distance counter 25 Distance Lj to a left lateral It is based. (3) Instead of xVo in a formula (Tj-T1), Lj-L1 is used, an operation is made, and it is j-th lead pin 10j. Amount of height gaps deltaZj deltaZj ={(Lj-L1) -(W+L)x(i-1)} xtan phi -- (8)
It becomes.
[0055] Moreover, j-th lead pin 10j sent from a distance counter 26 in the number arithmetic circuit 20 of disappearance pins Distance L'j to a right lateral And lead pin 10k of the j-th degree sent from a distance counter 25 Distance Lk to a left lateral It is based. (5) Instead of xVo in a formula (Tk-T'j), Lk-L'j is used, an operation is made, and it is disappearance pin several m. m=(Lk-L'j-L)/(W+L) -- (9)
It becomes. Moreover, j-th lead pin 10j Distance Lj to a left lateral Lj =L'j-W -- (10)
Since come out and it is m= {(Lk-Lj) -(W+L)} /(W+L) -- (11)
You may carry out.
[0056] In addition, as a distance detection means at this time, a linear length measuring machine, a rotary encoder, the sending-out pulse count to a pulse motor, angle-of-rotation detection of a polygon mirror with a laser scan, etc. can specifically be considered. Moreover, it sets in the 1st example of the above, and they are two or more lead pin 10i. Although amount of height gaps deltaZ of a lead pin and disappearance pin several m were measured on the assumption that there was no location gap in the alignment direction, and the existence of the defect of a lead pin was distinguished Lead pin 10i If the manufacture approach of the brush 11 which it has, and the approach of dealing with it are caused how, it may not shift perpendicularly, but it may shift horizontally and a location gap may be produced.
[0057] Of course, it is possible to measure amount of location gaps deltaX using the lead pin test equipment by the 1st example of the above also in this case. However, in order to measure amount of height gaps deltaZ easily and correctly in the case of the 1st example of the above, it was made desirable whenever [illuminating-angle / of spot light] for phi to be small as much as possible within the limits of the above-mentioned (1) formula. However, when measuring amount of location gaps deltaX of a lead pin, in order to make the measurement easily and exact, it is desirable to make phi into a perpendicular or the include angle near it whenever [illuminating-angle / of spot light].
[0058] then -- next, two or more lead pin 10i The lead pin test equipment which measures amount of location gaps deltaX [of a lead pin] and disappearance pin several m on the assumption that there is no gap in the height direction from an alignment side is explained in full detail as the 2nd example. The lead pin test equipment of the brush which transmits a signal to the revolving shaft by the 2nd example of this invention is explained using drawing 7 and drawing 8 .
[0059] Drawing 7 (a), (b), and (c) are the schematic diagrams showing arrangement of 1 set of light

emitters and receivers when seeing a subject-of-examination slack brush from a side face and a flat surface, respectively, and drawing 8 is a block flow diagram which shows the circuitry which processes the output signal of an electric eye. In addition, the same sign is given to the same component as the lead pin test equipment shown in above-mentioned drawing 1 and drawing 2 , and the explanation is omitted.

[0060] 1 set of light emitters and receivers which consist of the **** projectors 13 and the **** electric eyes 14 of the 1st example of the above in this 2nd example are lead pin 10i. 1 set of light emitters and receivers which consist of vertical illuminators 27 and perpendicular electric eyes 28 as shown in drawing 7 are lead pin 10i to being aslant arranged to an alignment side. The description is perpendicularly arranged to the alignment side.

[0061] In addition, in the circuitry which processes the output signal of an electric eye, if it removes that the amount arithmetic circuit 29 of location gaps is formed instead of the amount arithmetic circuit 19 of height gaps as shown in drawing 8 , it is the same as that of the case of the 1st example of the above almost. Next, it explains using the timing diagram of the output signal of the electric eye which shows the case where amount of location gaps deltaX of a lead pin is measured using the lead pin test equipment by the 2nd example to the block flow diagram and drawing 9 of drawing 8 .

[0062] now, it is shown in drawing 9 (a) -- as -- a subject of examination -- j-th lead pin 10j of lead pin 10i of a brush 11 Lead pin 10i the sense contrary to the sense which a brush 11 moves in the alignment direction -- deltaXj only -- it shall have shifted and there shall be no height gap from the alignment side It is lead pin 10i like the case of the 1st example of the above about the transparence table 12 which carried the brush 11 by the uniform driver. Rates [direction / alignment] Vo Spot light is irradiated from vertical illuminator 27, making it move. At this time, the spot light from vertical illuminator 27 is lead pin 10i. One with desirable irradiating a point is lead pin 10i, although it is the same as that of the case of the 1st example of the above. phi greatly differs whenever [illuminating-angle / of the spot light from vertical illuminator 27 to an alignment side].

[0063] Namely, lead pin 10i It is phi whenever [illuminating-angle / of the spot light from vertical illuminator 27 to an alignment side]. Phi=pi/2 -- (12)

Come out, and it is, therefore spot light is lead pin 10i. It irradiates perpendicularly. However, what is necessary is for this include angle not to be strict and just to irradiate it at a perpendicularly near include angle.

[0064] In this way, the spot light from vertical illuminator 27 is lead pin 10i. While irradiating a point, it is lead pin 10i. The spot light which passed through between is received by the perpendicular electric eye 28. And the shift time of day from an ON light condition to the protection-from-light condition to the electric eye 27 of spot light and the shift time of day ti from a protection-from-light condition to an ON light condition, i.e., ON / off time of day of an output signal, And ON / off time-of-day t'i The time-of-day detector 15 detects and it is j-th lead pin 10j. The ON / off time of day tj to depend It counts with ON / off time-of-day counter 17.

[0065] Subsequently, several j, and ON / off time of day tj from ON / off time-of-day counter 17 of the lead pin made into the object from the number counter 16 of pins in the amount arithmetic circuit 29 of location gaps It is based and is amount of location gaps deltaXj. It calculates. Namely, j-th lead pin 10j ON / off time of day tj tj ={(W+L)x(j-1)+deltaXj}/Vo+t1 -- (13)

Next door, therefore j-th lead pin 10j Amount of location gaps deltaXj deltaXj = {(tj-t1) xVo-(W+L)x (j-1)} -- (14)

It becomes.

[0066] In addition, it is almost the same as the case in the 1st example of the above, therefore the actuation which measures disappearance pin several m of a lead pin with the lead pin test equipment by the 2nd example is disappearance pin several m. m= {(tk-t'j) xVo-L} /(W+L) -- (15)

It becomes.

[0067] Amount of location gaps deltaXj of the lead pin measured as mentioned above And disappearance pin several m, while memorizing as data in the amount store circuit 21 of measurement, in the defective judging circuit 22, the final distinction about the defect of a lead pin based on such total

quantity is made. Thus, it is lead pin 10i by the uniform driver about the brush 11 which transmits a signal to a revolving shaft according to the 2nd example. Rates [direction / alignment] Vo Making it move It is lead pin 10i by vertical illuminator 27. A point is perpendicularly irradiated to the alignment side. Lead pin 10i The spot light which passed through between is received by the perpendicular electric eye 28. ON / off time of day ti of the output signal of the perpendicular electric eye 28 And the time-of-day detector 15 detects OFF/ON time-of-day t'i. Amount of location gaps deltaX [of a lead pin] and disappearance pin several m is measurable by calculating based on (14) and (15) types in the amount arithmetic circuit 29 of location gaps, and the number arithmetic circuit 20 of disappearance pins.
[0068] Therefore, amount of location gaps deltaX [of these lead pins], and disappearance pin several m, while memorizing as data in the amount store circuit 21 of measurement, finally in the defective judging circuit 22, the existence of the defect of a lead pin can be distinguished based on such total quantity. In addition, as the 1st example of the above was described, it is lead pin 10i. Instead of moving the direction, uniform migration of the light emitter and receiver may be carried out. Moreover, a driver and a relative-speed-detector sensor may be installed instead of a uniform driver. Furthermore, a distance detection means may be used.
[0069] However, in order to measure amount of location gaps deltaX easily and correctly in the 2nd example of the above, spot light is lead pin 10i. It is made desirable to irradiate a point. However, it differs from the case where it shows in above-mentioned drawing 7 in measuring disappearance pin several m of a lead pin, and spot light is lead pin 10i. It is desirable to irradiate root Motobe.
[0070] For example, as shown in drawing 10 (a), a location gap of a lead pin is very large, and the spacing A of the lead pin in a point A - 2 L+W -- (16)
When having become and spot light irradiates the point of a lead pin, as shown in drawing 10 (b), there is a possibility of taking for the case where the lead pin has disappeared. On the other hand, when root Motobe of a lead pin is irradiated, the spacing a of the lead pin in root Motobe is even if it is a however big location gap. a<2 L+W -- (17)
Since it becomes, there is no possibility of taking for the lead pin having disappeared. Therefore, in order to measure disappearance pin several m of a lead pin, to be stabilized and to distinguish the existence, spot light is lead pin 10i. It is desirable to irradiate root Motobe.
[0071] Moreover, it sets to one side and the 1st and 2nd examples of the above are lead pin 10i. Amount of height gaps deltaZ and disappearance pin several m are measured for there being no location gap as a premise. It sets on another side and is lead pin 10i. Amount of location gaps deltaX and disappearance pin several m is measured on the assumption that there is no height gap, but it is not few also when **, location gap, and height gap of an IC package like a lead pin compound and arise, for example.
[0072] Then, next, the thing to carry out to that phi is an acute angle as much as possible within the limits of the above-mentioned (1) formula whenever [illuminating-angle / of spot light], a perpendicular, or the include angle near it, A demand which is [irradiate / that spot light irradiates the point of a lead pin and root Motobe] different is satisfied. The lead pin test equipment which can measure the variation rate which the location gap and the height gap compounded, and can measure further the collective amount of inclinations of the lead pin which was impossible for measurement in the 1st and 2nd examples of the above is explained in full detail as the 3rd example.
[0073] Next, the lead pin test equipment of the IC package by the 3rd example of this invention is explained using drawing 11 and drawing 12 . Drawing 11 (a) and (b) are the schematic diagrams showing arrangement of 3 sets of light emitters and receivers when seeing a subject-of-examination slack IC package from a side face and a flat surface, respectively, and drawing 12 is a block flow diagram which shows the circuitry which processes the output signal of an electric eye.
[0074] IC package 31 by which two or more lead pin 30i (i= 1, 2, --, n) is pulled out from each side face is carried on the transparence table 32 which penetrates light. And this transparence table 32 is lead pin 30i by the uniform driver (not shown). Uniform migration is carried out in the alignment direction. Moreover, the 1st vertical illuminator 33 which irradiates spot light, respectively, the **** projector 34, and the 2nd vertical illuminator 35 are installed above the transparence table 32. The 1st vertical illuminator 33 of them is lead pin 30i. A point is irradiated almost perpendicularly to the alignment side.

The **** projector 34 is lead pin 30i. Irradiating a point with the predetermined include angle phi to the alignment side, the 2nd vertical illuminator 35 is lead pin 30i. Root Motobe is irradiated almost perpendicularly to the alignment side. Moreover, the 1st vertical illuminator 33 and 2nd vertical illuminator 35 are that installation top and lead pin 30i at this time. Only distance b is separated in the alignment direction.

[0075] Furthermore, under the transparence table 32, the 1st vertical illuminator 33, the **** projector 34, and the 2nd vertical illuminator 35 are faced, the 1st perpendicular electric eye 36, the **** electric eye 37, and the 2nd perpendicular electric eye 38 are installed, respectively, and it is lead pin 30i. The spot light from the 1st vertical illuminator 33 which passed through between, the **** projector 34, and the 2nd vertical illuminator 35 is received, respectively. In this way, lead pin 30i 3 sets of light emitters and receivers which face across an alignment side in between are arranged.

[0076] moreover, to the perpendicular electric eye 36 of these 1st, the **** electric eye 37, and the 2nd perpendicular electric eye 38 Lead pin 30from ON light condition of spot light from 1st vertical illuminator 33, **** projector 34, and 2nd vertical illuminator 35 i Shift time of day to the protection-from-light condition to depend, or shift time of day from a protection-from-light condition to an ON light condition, Namely, ON / off time of day ti of the output signal of the 1st perpendicular electric eye 36, the **** electric eye 37, and the 2nd perpendicular electric eye 38, Ti, taui and (i= 1, 2, --, n) OFF/ON time-of-day t'i, T'i, tau'i (i= 1, 2, --, n) The time-of-day detectors 39, 40, and 41 to detect are connected, respectively.

[0077] Moreover, in the time-of-day detector 39, it is lead pin 30i. The number counter 42 of pins, and ON / off time of day ti which also counts a number The ON / off time-of-day counter 43 to count are connected. In the time-of-day detector 40, they are ON / off time of day Ti. The ON / off time-of-day counter 44 to count are connected. In the time-of-day detector 41 The ON / off time-of-day counter 45, and OFF/ON time-of-day tau'i which count ON / off time-of-day taui OFF/ON time-of-day counter 46 to count is connected.

[0078] moreover, to ON / off time-of-day counter 43, and the number counter 42 of pins The amount arithmetic circuit 47 of location gaps which calculates amount of location gaps deltaX is connected. To ON / off time-of-day counter 44, and the number counter 42 of pins The amount arithmetic circuit 48 of height gaps which calculates amount of height gaps deltaZ is connected. To ON / off time-of-day counter 43, and the ON / off time-of-day counter 45 Collective amount of inclinations deltaXs of a lead pin The amount arithmetic circuit 49 of inclinations to calculate is connected, and the number arithmetic circuit 50 of disappearance pins which calculates disappearance pin several m of a lead pin is connected to ON / off time-of-day counter 45, and OFF/ON time-of-day counter 46.

[0079] Furthermore, while the number counter 42 of pins, the amount arithmetic circuit 47 of location gaps, the amount arithmetic circuit 48 of height gaps, the amount arithmetic circuit 49 of inclinations, and the number arithmetic circuit 50 of disappearance pins are connected to the total quantity store circuit 51, the amount arithmetic circuit 47 of these locations gaps, the amount arithmetic circuit 48 of height gaps, the amount arithmetic circuit 49 of inclinations, and the number arithmetic circuit 50 of disappearance pins are connected to the defective judging circuit 52 which finally distinguishes the defect of a lead pin.

[0080] Next, it explains using the timing diagram of the output signal of the electric eye which shows the case where amount of location gaps deltaX of a lead pin and amount of height gaps deltaZ are measured using the lead pin test equipment by the 3rd example to the block flow diagram and drawing 13 of drawing 12 . Now, as shown in drawing 13 (a), it is each lead pin 30i of IC package 31 as a subject of examination. Width of face W, the thickness -- H and spacing which aligned normally -- L -- carrying out -- j-th lead pin 30j Lead pin 30i the sense contrary to the sense which IC package 31 moves in the alignment direction -- deltaXj only -- shifting -- the still more nearly perpendicular direction from the alignment side -- facing down -- deltaZj only -- suppose that it has shifted.

[0081] First, they are two or more lead pin 30i by the uniform driver (not shown) about this transparence table 32 after carrying subject-of-examination slack IC package 31 on the transparence table 32. Rates [direction / alignment] Vo Spot light is irradiated from the 1st vertical illuminator 33 and ****

projector 34, making it move. And the spot light from these 1st vertical illuminators 33 and the **** projector 34 is lead pin 30i. While irradiating a point, it is lead pin 30i. It passes through between and ON light is carried out to the 1st perpendicular electric eye 36 and **** electric eye 37.
[0082] And lead pin 30from ON light condition to 1st perpendicular electric eye 36 of spot light irradiated almost perpendicularly from 1st vertical illuminator 33 like case of 2nd example of the above i Shift time of day to the protection-from-light condition to depend, and shift time of day from a protection-from-light condition to an ON light condition, Namely, ON / off time of day ti of an output signal And OFF/ON time-of-day t'i The time-of-day detector 39 detects and it is j-th lead pin 30j. The ON / off time of day tj to depend It counts with ON / off time-of-day counter 43.
[0083] Moreover, lead pin 30from ON light condition to 2nd electric eye 37 of spot light irradiated with predetermined include angle phi like case of 1st example of the above from **** projector 34 i Shift time of day to the protection-from-light condition by the upper left hand corner (- shows in drawing 13 (a)), Namely, lead pin 30from ON/OFF time-of-day [of an output signal] Ti, and (- shows in drawing 13 (c)) protection-from-light condition i Shift time of day to the ON light condition by the lower right angle (O shows in drawing 13 (a)), Namely, ON/OFF time of day Tj the time-of-day detector 40 detects OFF/ON time-of-day T'i (- shows in drawing 13 (c)) of an output signal, and according to j-th lead pin 30j It counts with ON/OFF time-of-day counter 44.
[0084] Subsequently, the ON / off time of day tj from several j, and the ON / off time-of-day counters 43 and 44 of the lead pin made into the object from the number counter 42 of pins in the amount arithmetic circuit 47 of location gaps, and the amount arithmetic circuit 48 of height gaps, and Tj It is based and is amount of location gaps deltaXj. And amount of height gaps deltaZj It calculates. Namely, j-th lead pin 30j The ON / off time of day tj to depend, and Tj tj ={(W+L)x(j-1)+deltaXj}/Vo+t1 -- (18)
Tj ={(W+L)x(j-1)+deltaXj+deltaZj/tan phi}/Vo+T1 -- (19)
Next door, therefore j-th lead pin 30j Amount of location gaps deltaXj deltaXj = {(tj-t1) xVo-(W+L)x (j-1)} -- (20)
A next door and amount of height gaps deltaZj deltaZj ={(Tj-T1) xVo-(W+L)x(j-1)-deltaXj} xtan phi = {(Tj-T1) xVo-(tj-t1) xVo} xtan phi -- (21)
It becomes.
[0085] Next, the lead pin test equipment by the 3rd example is used, and it is collective amount of inclinations deltaXs of a lead pin. Lead pin 30i which shows the case where it measures to the block flow diagram and drawing 14 of drawing 12 It explains using an expansion top view. Now, as shown in drawing 14 , it is lead pin 30i of IC package 31. Suppose that the uniform location gap is produced altogether. Since it is undetectable depending on the 1st perpendicular electric eye 36 and **** electric eye 37 in the 1st vertical illuminator 33 and **** projector 34 list, such a collective inclination is lead pin 30i. It detects using the 1st and 2nd perpendicular electric eyes 36 and 38 corresponding to the 1st and 2nd vertical illuminators 33 and 35 and these which irradiate a point and root Motobe almost perpendicularly to the alignment side.
[0086] It is lead pin 30i about the transparence table 32 which carried subject-of-examination slack IC package 31 like the case where amount of location gaps deltaX and amount of height gaps deltaZ is measured. Rates [direction / alignment] Vo Spot light is irradiated from the 1st and 2nd vertical illuminators 33 and 35, making it move. And the shift time of day from an ON light condition to the protection-from-light condition to the 1st perpendicular electric eye 36 of the spot light from the 1st vertical illuminator 33, Namely, ON / off time of day ti of the output signal of the 1st perpendicular electric eye 36 Shift time of day from an ON light condition to the protection-from-light condition to the 2nd perpendicular electric eye 38 of the spot light from the 2nd vertical illuminator 35, Namely, ON / off time-of-day taui of the output signal of the 2nd perpendicular electric eye 38 The time-of-day detectors 39 and 41 detect, respectively, and it counts with ON / off time-of-day counters 43 and 45.
[0087] Subsequently, it sets to the amount arithmetic circuit 49 of inclinations, and they are the ON / off time of day ti from ON / off time-of-day counters 43 and 45, and taui. It is based and the amount of inclinations is calculated like the case of the 1st example of the above. Here, it is lead pin 30i. Distance deltaXs of the alignment direction from root Motobe to a point Lead pin 30i If it is the collective amount

of inclinations, it is amount of inclinations deltaXs. deltaXs =(ti-taui) xVo-b -- (22)
however, i= -- it is set to 1, 2, --, n.
[0088] Next, disappearance pin several m of a lead pin is measured using 1 set of light emitters and receivers which consist of the 2nd vertical illuminator 35 in the lead pin test equipment by the 3rd example, and the 2nd perpendicular electric eye 38. The actuation in this case is lead pin 30i. It is almost the same as a case [in / the difference in whether root Motobe is irradiated or a point is irradiated, and / in others / the 2nd example of the above]. [that] Therefore, disappearance pin several m m= {(tauk - tau'j) xVo-L} /(W+L) -- (23)
It becomes.
[0089] Amount of location gaps deltaXj of the lead pin measured as mentioned above, amount of height gaps deltaZj, collective amount of inclinations deltaXs, and disappearance pin several m, while memorizing as data in the total quantity store circuit 51, in the defective judging circuit 52, the final distinction about the defect of a lead pin based on such total quantity is made. Thus, according to the 3rd example, it is lead pin 30i about IC package 31 by the uniform driver. Rates [direction / alignment] Vo Making it move It is lead pin 30i by the 1st vertical illuminator 33. A point is irradiated almost perpendicularly to the alignment side. It is lead pin 30i by the **** projector 34. A point is irradiated with the predetermined include angle phi to the alignment side. It is lead pin 30i by the 2nd vertical illuminator 35. Root Motobe is irradiated almost perpendicularly to the alignment side. Lead pin 30i ON / off time of day ti of the output signal of the 1st perpendicular electric eye 36 which received the spot light from the 1st vertical illuminator 33 which passed through between, the **** projector 34, and the 2nd vertical illuminator 35, respectively, the **** electric eye 37, and the 2nd perpendicular electric eye 38, and Ti, taui And OFF/ON time-of-day t'i, T'i, tau'i The time-of-day detectors 39, 40, and 41 detect, respectively. By calculating based on (20) - (23) type in the amount arithmetic circuit 47 of location gaps, the amount arithmetic circuit 48 of height gaps, the amount arithmetic circuit 49 of inclinations, and the number arithmetic circuit 50 of disappearance pins Amount of location gaps deltaX of a lead pin, amount of height gaps deltaZ, collective amount of inclinations deltaXs, and disappearance pin several m are measurable, respectively.
[0090] Therefore, amount of location gaps deltaX of these lead pins and amount of height gaps deltaZ, collective amount of inclinations deltaXs, and disappearance pin several m, while memorizing as data in the total quantity store circuit 51, finally in the defective judging circuit 52, the defect of a lead pin can be distinguished based on such total quantity. In addition, in the 3rd example, uniform migration of 3 sets of light emitters and receivers may be carried out instead of carrying out uniform migration of the transparence table 32 which carried IC package 31 by the uniform driver like the case of the 1st and 2nd examples of the above.
[0091] Moreover, it is lead pin 30i about the transparence table 32 instead of a uniform driver. The relative-speed-detector sensor which detects the passing speed by the driver which makes it move in the alignment direction, and its driver may be installed. Moreover, based on distance information, amount of location gaps deltaXj of a lead pin, amount of height gaps deltaZj, and disappearance pin several m may be measured by using distance detection means, such as a linear length measuring machine, instead of rate information.
[0092] Next, the lead pin test equipment of the IC package by the 4th example of this invention is explained using drawing 15 thru/or 17. Drawing 15 is the principle explanatory view of this example, and drawing 16 is drawing showing the example used as a light-emitter-and-receiver unit based on the principle of this example shown in drawing 15 . Drawing 17 is drawing explaining the inspection approach of lead pin deflection.
[0093] Although two or more pairs of light-emitter-and-receiver units from which an illuminating angle differs by making one projector and one electric eye into a pair were used in the 3rd example mentioned above, it constitutes from this example as a light-emitter-and-receiver unit which prepared two or more electric eyes to one projector. The principle explanatory view of drawing 15 shows the case where two electric eyes are used to one projector.
[0094] IC package 104 which is a subject of examination and by which two or more lead pins 106 are

pulled out from each side face is carried on the transparence table 108 which penetrates light. The projector 100 which irradiates light is formed above the transparence table 108, and the optical system which makes a subject the lens 102 which condenses the light from a projector 100 is prepared in the lower part of a projector 100.
[0095] Two electric eyes 110 are installed in the include-angle theta direction to optical-axis Z-Z' of a projector 100 by the lower part of the transparence table 108. It is condensed by the optical system which makes a lens 102 a subject, and the light emitted from the projector 100 turns into light which has the breadth of an include angle theta to optical-axis Z-Z' of a projector 100. The light which carried out incidence aslant at an angle of theta to IC package 104 passes through between the lead pins 106, and it carries out incidence to an electric eye 110.
[0096] Thus, the light which carries out incidence to the electric eye 110 on either side is irradiated at a mutually different include angle to IC package 104. Therefore, light with a different illuminating angle is realizable with one projector 100. It unites with the support frame 120 which carried out the shape of a typeface of one projector 100 and four electric eyes 112, 114, 116, and 118KO, and the light-emitter-and-receiver unit of the lead pin test equipment by this example is formed, as shown in drawing 16 . Four electric eyes 112, 114, 116, and 118 are arranged on two straight lines of the spot 124 condensed by optical system 122 which go direct in the center mostly, X-X', and Y-Y'. Moreover, IC package 104 to inspect is placed between optical system 122 and two or more electric eyes 112, 114, 116, and 118. In addition, although IC package 104 was put on the transparence table 108, only IC package 104 was illustrated here for simplification.
[0097] The alignment direction of the lead pin 106 of IC package 104 to inspect is now doubled in the direction of Y-Y', and the direction of relative motion is also made into the direction (the direction of an arrow head in drawing) of Y-Y'. At this time, since the light which carried out incidence to electric eyes 112 and 114 is deflected in the perpendicular direction to the direction of relative motion, it can be considered to the lead pin 106 that it is vertical-incidence light. Moreover, since the light which carried out incidence to electric eyes 116 and 118 is deflected in the direction of relative motion, it can be considered to the lead pin 106 that it is oblique-incidence light.
[0098] Thus, the function same with using the light-emitter-and-receiver unit of two perpendicular directions and the light-emitter-and-receiver unit of the two directions of slant can be obtained by using the light-emitter-and-receiver unit by this example. Therefore, as shown in the 3rd example of the above, the amount of location gaps, the amount of height gaps, the collective amount of inclinations, and the number of disappearance pins of the lead pin 106 are measurable.
[0099] Next, measurement of lead pin deflection is explained as an example of the measurement in this example. As shown in drawing 17 , when the lead pin 106 which has the deflection of the include angle of alpha in the direction of X-X' is a subject of examination, if the lead pin 106 moves in the direction of Y[from Y] ', the light which carries out incidence to an electric eye 114 will be interrupted when the lead pin 106 reaches at an A point, but the light which carries out incidence to an electric eye 112 does not interrupt light until the lead pin 106 reaches at a B point. This can be used and corner of a street alpha of a lead pin and pin disappearance can be searched for from count by detecting the distance of an A point and a B point using the relative-speed-detector sensor 23 or the distance detection sensor 24.
[0100] Thus, according to this example, all inspection of a lead pin is possible by the light-emitter-and-receiver unit constituted by the projector of a piece, and two or more electric eyes. Moreover, since a series of inspection in one light-emitter-and-receiver unit is possible, an attachment tooth space is reducible. Furthermore, since the distance between four electric eyes can be contracted, the migration length of the lead pin at the time of inspecting also becomes short, and can shorten the inspection processing time.
[0101] In addition, although the direct electric eye 110 had received the light emitted from the projector 100 in the light-emitter-and-receiver unit shown in drawing 15 , as shown in drawing 18 , two or more linear members 156 which transmit light, such as an optical fiber, may be arranged, and a light-receiving function may be further given by the thing [connecting an electric eye 110 previously]. Moreover, as shown in drawing 19 , the mask 160 which a detailed hole 158 like a pinhole opened ahead of the linear

member 156 which transmits light, such as an electric eye or an optical fiber, may be arranged, the intensity of light which receives light may be adjusted, or invasion of disturbance light may be prevented and stabilization of a light-receiving function may be achieved.

[0102] Moreover, in the light-emitter-and-receiver unit of drawing 15 , although the electric eye 110 has been arranged on the same periphery, as long as the intensity of light is an almost equal point, you may arrange not only a periphery top but on the periphery of other configurations, such as an ellipse. Next, the lead pin test equipment of the IC package by the 5th example of this invention is explained using drawing 20 thru/or 24.

[0103] Drawing 20 is the principle explanatory view of this example. Drawing 21 is a schematic diagram explaining the lead pin test equipment by this example, and drawing 22 is a block flow diagram which shows the digital disposal circuit of lead pin test equipment. Drawing 23 and drawing 24 are the explanatory views of the lead pin test equipment shown in drawing 21 of operation. In the 4th example mentioned above, one light-emitter-and-receiver unit shown in drawing 16 showed that lead pin inspection was possible. In the lead pin test equipment of this example, the bidirection which is another advantage of the light emitter and receiver shown in drawing 16 is used.

[0104] The principle of this example is explained using drawing 20 . Drawing 20 (a) shows the principle when, as for drawing 20 (b), the lead pin 106 moves a principle when the lead pin 106 moves to the right from the left to the left from the right. In addition, Y-Y' in drawing supports the notation of drawing 16 . When the lead pin 106 is moved to the left from the right, the light which the light which carries out incidence to an electric eye 116 is interrupted in the inferior-surface-of-tongue edge B point of the lead pin 106, and carries out incidence to an electric eye 118 is interrupted in the top-face edge A point of the lead pin 106. When a lead pin is moved to the right from the left, the light which the light which carries out incidence to an electric eye 118 is interrupted at the inferior-surface-of-tongue edge C point of the lead pin 106, and carries out incidence to an electric eye 116 is interrupted at the top-face edge D point of the lead pin 106.

[0105] Since unifying is desirable as for the detection side (a top face or inferior surface of tongue) of the lead pin 106 in case the lead pin 106 is inspected, when it has only one electric eye in the direction of Y-Y', the migration direction of the lead pin 106 is limited to a right one direction from the left or the left from the right. However, the lead pin 106 becomes possible [moving to right-and-left both directions] by arranging two electric eyes. However, it is necessary to choose the electric eye 116 detected according to the migration direction, or 118 in that case. That is, what is necessary is to detect an A point using an electric eye 118, in case it moves leftward, and just to detect D point using an electric eye 116, in case it moves rightward when the top face of the lead pin 106 is made into a detection side.

[0106] The lead pin test equipment by this example is explained using drawing 21 . Drawing 21 (a) and (b) show the plan and side elevation of lead pin equipment, respectively. On the slide guide 130 fixed to the foundation 128, the slide table 132 which moves to right and left is formed. Four light-emitter-and-receiver units 134, 136, 138, and 140 for inspecting the lead pin 106 are formed in the slide table 132. In addition, the light-emitter-and-receiver units 134, 136, 138, and 140 are shown in drawing 16 . Moreover, the work-piece susceptor 152 for putting IC package 104 to inspect between the projector 110 of the light-emitter-and-receiver units 134, 136, 138, and 140 and electric eyes 112, 114, 116, and 118 is arranged.

[0107] The transfer robot 142 which conveys IC package 104 is attached in the gastrostyle 144 fixed to the foundation 128, and rotates focusing on a gastrostyle 144. Moreover, four arms 146 with which the IC chuck 148 was attached at the tip and which intersect a right angle are prepared for the transfer robot 142, and four IC packages 104 can be carried to coincidence.

[0108] Moreover, vertical migration is possible for a gastrostyle 144, as shown in drawing 21 (b), in case IC package 104 is gripped or released, it moves downward, and in case a transfer robot is rotated, it moves upwards. The circuitry which processes the output signal of the light-emitter-and-receiver units 134, 136, 138, and 140 is explained using drawing 22 .

[0109] The time-of-day detectors 39 and 41 are connected to the 1st perpendicular electric eye 112 of

each light-emitter-and-receiver unit, and the 2nd perpendicular electric eye 114, respectively. Moreover, the 1st **** electric eye 116 and the 2nd **** electric eye 118 are connected to the time-of-day detector 40 through the change machine 162. The change machine 162 serves to change which [of electric eyes 116 and 118] is connected to the time-of-day detector 40 based on a change signal.
[0110] Since it is the same as that of the 3rd example about others, explanation is omitted. Next, actuation of the lead pin test equipment of this example is explained using drawing 21 **** 24. Drawing 23 shows actuation of the both-way slide table 132 in the case of lead pin inspection, and drawing 24 is drawing showing the location of the lead pin at the time of IC package 104 being carried by the transfer robot 142.
[0111] Suppose that IC package 104 of the square which has a lead pin in four sides as shown in drawing 24 now is inspected. IC package 104 is supplied to the supply stage 150, where the index mark 164 which shows arrangement of the lead pin 106 is made into the lower left. IC package 104 supplied to the supply stage 150 is carried by the transfer robot 142 at the A point of the work-piece susceptor 152. An A point is in the location of 90 degrees from the supply stage 150 focusing on the transfer robot's 142 gastrostyle 144. That is, 90 degrees of IC packages 104 supplied on the supply stage 150 rotate by moving to an A point, and they move the index mark 164 of IC package 104 to the upper left.
[0112] What is necessary is just to move rightward the both-way slide table 132 in the location shown in drawing 23 (a), in order to inspect IC package 104 placed at the A point. This conducts lead pin inspection of two sides of upper and lower sides of IC package 104 using the light-emitter-and-receiver units 134 and 136. That is, the 1st lead pin train 166 and the 2nd lead pin train 168 are inspected by the light-emitter-and-receiver units 134 and 136, respectively.
[0113] Termination of the inspection in an A point carries IC package 104 from the A point of the work-piece susceptor 152 with the transfer robot 142 at the B point of the work-piece susceptor 152. Similarly, a B point is in the location of 90 degrees from an A point focusing on the transfer robot's 142 gastrostyle 144. For this reason, 90 more degrees of IC packages 104 rotate, and they move an index mark to the upper right. Moreover, the 1st lead pin train 166 and the 2nd lead pin train 168 which were inspected in the A point serve as right-hand side of IC package 104, and left-hand side, respectively.
[0114] By the above-mentioned inspection, the both-way slide table 132 will move to the right-hand side of a slide guide 130, and as shown in drawing 23 (b), the light-emitter-and-receiver units 138 and 140 will be located in the right-hand side of a B point. Therefore, what is necessary is just to move the both-way slide table 132 leftward shortly, in order to inspect IC package 104 placed at the B point. This conducts lead pin inspection of remaining two sides of IC package 104 using the light-emitter-and-receiver units 138 and 140. That is, the 3rd lead pin train 170 and the 4th lead pin train 172 are inspected by the light-emitter-and-receiver units 138 and 140, respectively.
[0115] In addition, since it is necessary to change the electric eyes 116 and 118 of the **** direction in case the migration direction of the both-way slide table 130 is made reverse, as mentioned above, the electric eye of the **** direction connected to the time-of-day detector 40 using the change machine 162 is changed. After the inspection in a B point is completed, IC package 104 is taken out from the B point of the work-piece susceptor 152 with the transfer robot 142, is carried to a stage 154, and ends an inspection process here.
[0116] Moreover, in a series of above-mentioned procedures, it is possible to inspect to coincidence IC package 104 which is different in the A point and B point of the work-piece susceptor 152. Thus, according to this example, the light-emitter-and-receiver unit of a lot with the projector of a piece and two or more electric eyes does not need to fix the migration direction over the lead pin alignment direction by changing two **** electric eyes. For this reason, when it uses as lead pin test equipment as shown in drawing 21 , it is not necessary to return the both-way slide table 132 at every inspection, and inspection time amount can be shortened.
[0117] Next, the positional controller which controls the relative location of two fields by the 6th example of this invention is explained using drawing 25 . Drawing 25 (a) and (b) are the schematic diagrams showing arrangement of 1 set of light emitters and receivers when seeing the field of two controlled-system slack from a side face, respectively, and drawing 25 (c) is the timing diagram of the

output signal of the electric eye of the positional controller.
[0118] As shown in drawing 25 (a), two fields of the Ath page and the Bth page set a certain spacing, and have met in parallel. And the optical system 60 to which the television camera etc. is connected is being fixed to the Ath page, and, as for the point of the optical system 60, only distance d has projected caudad from the Ath page. Moreover, from the normal stood to the Ath page, the projector 61 which irradiates spot light leans only an include angle phi to the Ath page, and is being fixed to it.
[0119] The electric eye 62 which receives spot light leans only an include angle phi from the normal stood to the Bth page in the flat surface of the optical axis of a projector 61, and the normal stood to the Bth page to make, and is being fixed to the Bth page of another side. Moreover, a stage 63 can be attached in the inferior surface of tongue of the Bth page, and it can move now only in the direction of the z-axis by the driver (not shown). Moreover, as shown in drawing 25 (b), when spacing of the Ath page and the Bth page becomes the predetermined distance D, the mutual optical axis of the electric eye [the projector 61 fixed to the Ath page and] 62 fixed to the Bth page corresponds, and it is arranged so that the spot light from a projector 61 may be received by the electric eye 62. And it is the distance f from optical-system 60 point to the Bth page, i.e., the working distance of optical system 60, (distance whose focus suits) at this time. f=D-d -- (24)
It becomes.
[0120] Therefore, when it moved in the direction of the z-axis by the driver on the stage 63 and the distance of the Ath page and the Bth page is set to D in the condition of irradiating spot light from the projector 61, as shown in drawing 25 (c), a predetermined detecting signal is outputted from an electric eye 62. Thus, while according to the 6th example leaning only an include angle phi to the Ath page which meets in parallel, and the Bth page from the normal stood to those fields and fixing a projector 61 and an electric eye 62 to it Since the spot light from a projector 61 is received by the electric eye 62 and a predetermined detecting signal is outputted, when the Bth page becomes the predetermined distance D with the Ath page by moving one Bth page in the direction of the z-axis by the driver, It is correctly [easily and] controllable to the working distance f of optical system 60. Moreover, the automatic focus of optical system 60 becomes possible by connecting the output and driver of an electric eye 62 and stopping migration automatically by the predetermined detecting signal.
[0121] In addition, in the 6th example of the above, although a driver moves only in the direction of the z-axis on a stage 63, it may attach the driver which moves also in the direction of a x axis, and the direction of the y-axis further. In this case, not only the automatic focus of optical system 60 but the alignment of the direction of a x axis optical system 60 and for [on the Bth page] observation and the direction of the y-axis becomes possible. Moreover, the migration by such driver may move not only a Bth page side but an Ath page side, or may move both both sides.
[0122] Moreover, in the 6th example of the above, although a projector 61 is fixed to the Ath page and the electric eye 62 is fixed to the Bth page, you may attach conversely mutually. Moreover, in the 6th example of the above, although the Ath page and the case where the Bth page had met in parallel were explained, also when not parallel, this invention can be applied. In this case, the distance of the predetermined point in not control but the Ath page of the distance D of the Ath page and the Bth page and the predetermined point in the Bth page will be controlled.
[0123] Moreover, as for the spot light irradiated from a projector 61, fully being extracted is desirable. the predetermined detecting signal outputted from the electric eye 62 shown in drawing 25 (b) -- width of face -- as long as -- it is because it becomes there is nothing and small, therefore the working distance f of optical system 60 will be controlled with high precision. Next, the positional controller which controls the relative location of two fields by the 7th example of this invention is explained using drawing 26 and drawing 27 .
[0124] Drawing 26 (a) and (b) are the schematic diagrams showing arrangement of 3 sets of light emitters and receivers when seeing the field of two controlled-system slack from a side face, respectively, and drawing 27 is the detection Fig. of the output signal of the electric eye of the positional controller. Although two fields of the Ath page and the Bth page set a certain spacing and have met as shown in drawing 26 (a), it is not necessarily parallel. And the 1st thru/or the 3rd projector 64, 65, and

66 which irradiates spot light are being fixed to the Ath page. The 1st projector 64 of them is attached at right angles to the Ath page, and the 2nd projector 65 leans only an include angle phi from the normal stood to the Ath page, and is attached, and from the normal stood to the Ath page, the 3rd projector 66 leans only an include angle psi, and is attached.
[0125] The 1st thru/or the 3rd electric eye 67, 68, and 69 which receives spot light are being faced and fixed to the Bth page of another side by the 1st thru/or the 3rd projector 64, 65, and 66, respectively. That is, the 1st electric eye 67 is attached at right angles to the Bth page, and the 2nd electric eye 68 leans only an include angle phi from the normal stood to the Bth page, and is attached, and from the normal stood to the Bth page, the 3rd electric eye 69 leans only an include angle psi, and is attached.
[0126] Moreover, the driver (not shown) which moves the location of the Ath page or the Bth page is prepared, and it is arranged so that the distance of the Ath page and the Bth page to make and the confrontation include angle of the Ath page and the Bth page to make can be changed by this driver. And the 1st thru/or the 3rd electric eye 67, 68, and 69 fixed to the 1st thru/or the 3rd projector 64, 65, and 66 fixed to the Ath page, and the Bth page As shown in drawing 16 (b), when the Bth page becomes parallel to the Ath page and spacing of the Ath page and the Bth page becomes the predetermined distance D, the optical axis of 3 sets of light emitters and receivers is in agreement, respectively. It is set up so that the 1st thru/or the spot light from the 3rd projector 64, 65, and 66 may be received by the 1st thru/or the 3rd electric eye 67, 68, and 69, respectively.
[0127] In therefore, the condition of irradiating spot light, from the 1st thru/or the 3rd projector 64, 65, and 66 When the Ath page or the Bth page is moved, the distance of the Ath page and the Bth page to make and the confrontation include angle of the Ath page and the Bth page to make were changed by the driver, the Bth page becomes parallel to the Ath page and spacing of the Ath page and the Bth page becomes the predetermined distance D As shown in drawing 27 , a predetermined detecting signal is outputted from the 1st thru/or the 3rd electric eye 67, 68, and 69, respectively.
[0128] Thus, while attaching 3 sets of light emitters and receivers which become the Ath page which meets, and the Bth page from the 1st the 3rd projector 64, 65, and 66 and the 1st thru/or the 3rd electric eye 67, 68, and 69 in the direction different, respectively according to the 7th example By changing the distance of the Ath page and the Bth page to make, and the confrontation include angle of the Ath page and the Bth page to make by the driver When the Bth page becomes parallel to the Ath page and spacing of the Ath page and the Bth page becomes the predetermined distance D Since the 1st thru/or the spot light from the 3rd projector 64, 65, and 66 are received by the 1st thru/or the 3rd electric eye 67, 68, and 69 and a predetermined detecting signal is outputted, respectively, It is correctly [easily and] controllable so that the Bth page becomes the parallel location which kept the Ath page which meets, and the predetermined distance D. Therefore, the automatic control of the parallelism of the Ath page which kept the predetermined distance D, and the Bth page becomes possible by connecting the 1st thru/or each output and driver of the 3rd electric eye 67, 68, and 69.
[0129] In the 7th example of the above in addition, the 1st projector 64 at right angles to the Ath page The 2nd projector 65 leans only an include angle phi from the normal stood to the Ath page, and from the normal stood to the Ath page, the 3rd projector 66 leans only an include angle psi, and is fixed, respectively. Moreover, although these [1st] thru/or the 3rd projector 64, 65, and 66 are faced and the 1st thru/or the 3rd electric eye 67, 68, and 69 are being fixed to the Bth page For example, as shown in drawing 28 , this 3rd projector 70 is faced instead of the 3rd projector 66 in it using the 1st projector 64 and the 3rd projector 70 similarly fixed at right angles to the Ath page. The same effectiveness can be done so even if it fixes the 3rd electric eye 71 at right angles to the Bth page instead of the 3rd electric eye 69. It is because the relative location of the Ath page and the Bth page can be decided if the directions of at least 2 sets of light emitters and receivers differ among 3 sets of light emitters and receivers fixed to a different location.
[0130] Moreover, in the 7th example of the above, although the case where it controlled so that the Bth page becomes parallel to the Ath page was explained, the Ath page and not only when the Bth page becomes parallel but the thing controlled to become a predetermined confrontation include angle is possible by adjusting the installation location of the light emitter and receiver of the group fixed to the

Ath page and the Bth page, and its direction.
[0131]
[Effect of the Invention] In the lead pin test equipment which inspects two or more lead pins which set predetermined spacing and aligned as mentioned above according to this invention While irradiating spot light with a predetermined include angle in the alignment side of two or more lead pins by the light emitter and receiver, moving the stage in which the light emitter and receiver or the inspected object was carried by the driving means in the alignment direction of two or more lead pins Receive the spot light which passed through between the lead pin, and a time-of-day detection means detects the shift time of day from an ON light condition to the protection-from-light condition of an electric eye, or the shift time of day from a protection-from-light condition to an ON light condition. Based on the shift time of day, the amount of displacement from the normal location of each lead pin or the number of deficits of a lead pin can be measured with an operation means, and the existence of the defect in two or more lead pins can be judged with a defective judging means based on the amount of measurement.
[0132] This becomes possible to inspect stably the defect of a location gap of a lead pin, a height gap, disappearance, a collective inclination, etc. by the high speed, high degree of accuracy, and the low price. Moreover, it sets to the positional controller which controls the relative location of the 1st field and the 2nd field which meet. When the location of the 2nd field where the 1st field or electric eye to which the projector was fixed was fixed is changed by the driving means and the 1st field and 2nd field become a relative predetermined location, the 1st field and 2nd field can be controlled to a predetermined relative location by making a mutual optical axis in agreement.
[0133] It enables this to control the relative location of two fields which meet by the high speed, high degree of accuracy, and the low price stably.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

TECHNICAL FIELD

[Industrial Application] This invention relates to the positional controller used for the automatic focus of the optical system of the lead pin test equipment which distinguishes the existence of the defect of a location gap of lead pins, such as components with two or more lead pins which were applied to lead pin test equipment and a positional controller, especially were pulled out from the side face, for example, the brush which transmits a signal to body of revolution, and an IC package, a height gap, disappearance, a collective inclination, etc., a microscope, etc., highly precise arrangement of a member, etc.

[Translation done.]

* NOTICES *

PRIOR ART

[Description of the Prior Art] The lead pin inspection approach of the conventional IC package which uses a CCD camera is explained using drawing 29 . Here, the schematic diagram and drawing 29 (c) which show arrangement of a CCD camera when drawing 29 (a) and (b) look at an IC package from a side face and a top face are drawing showing the incorporation image by the CCD camera of the lead pin of an IC package.

[0003] CCD camera 82 is installed in the side of IC package 81 by which two or more lead pin 80i (i= 1, 2, --, n) is pulled out from the side face. And this lead pin 80i Light is hit to an alignment side from a projector (not shown), and it picturizes with CCD camera 82. Moreover, this CCD camera 82 is lead pin 80i of the incorporation image which is connected to the predetermined display (not shown) and was displayed on this display to IC package 81. It inspects.

[0004] For example, they are two or more lead pin 80i like lead pin 80i (i= 3). Like a gap (it is hereafter called "a location gap") in the alignment direction, and lead pin 80i (i= 2) When having produced the gap (it is hereafter called "a height gap") in a direction perpendicular to the alignment direction, it can ask for amount of location gaps deltaX, or amount of height gaps deltaZ from the incorporation image shown in drawing 29 (c).

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

EFFECT OF THE INVENTION

[Effect of the Invention] It sets to the lead pin test equipment which inspects two or more lead pins which set predetermined spacing and aligned as mentioned above according to this invention, and is a driving means. While irradiating spot light with a predetermined include angle in the alignment side of two or more lead pins by the light emitter and receiver, moving the stage in which the light emitter and receiver or the inspected object was carried in the alignment direction of two or more lead pins Receive the spot light which passed through between the lead pin, and a time-of-day detection means detects the shift time of day from an ON light condition to the protection-from-light condition of an electric eye, or the shift time of day from a protection-from-light condition to an ON light condition. Based on the shift time of day, the amount of displacement from the normal location of each lead pin or the number of deficits of a lead pin can be measured with an operation means, and the existence of the defect in two or more lead pins can be judged with a defective judging means based on the amount of measurement.
[0132] This becomes possible to inspect stably the defect of a location gap of a lead pin, a height gap, disappearance, a collective inclination, etc. by the high speed, high degree of accuracy, and the low price. Moreover, it is a driving means about the location of the 2nd field where the 1st field or electric eye to which the projector was fixed was fixed in the positional controller which controls the relative location of the 1st field and the 2nd field which meet. When it is made to change and the 1st field and 2nd field become a relative predetermined location, the 1st field and 2nd field can be controlled to a predetermined relative location by making a mutual optical axis in agreement.
[0133] It enables this to control the relative location of two fields which meet by the high speed, high degree of accuracy, and the low price stably.

[Translation done.]

* NOTICES *

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, it sets to the lead pin inspection approach of the IC package which uses the above-mentioned conventional CCD camera, and is lead pin of one side 80i of IC package 81. It is difficult to store all in the visual field of CCD camera 82, and to inspect by one image pick-up, considering the resolution of CCD camera 82. Therefore, in order to obtain the resolving power more than fixed, multiple-times migration of IC package 81 or CCD camera 82 must be carried out, and the defect in which inspection time amount increases arises. In addition, although it is possible to aim at compaction of inspection time amount by installing two or more CCD cameras 82, the defect in which complicated-izing and a cost rise of test equipment are caused arises in this case.
[0011] Moreover, it sets to the lead pin inspection approach of the IC package which uses the above-mentioned conventional displacement sensor, and is lead pin 80i. In order to detect the laser beam reflected on the inferior surface of tongue by the displacement sensor 83, it is lead pin 80i. If a surface state at the bottom is caused how, the reflected light is changed and there is a defect in which the case where it becomes difficult for it to be stabilized and to detect the variation rate of height and the variation rate of spacing arises.
[0012] Moreover, lead pin 80i of IC package 81 Since width of face is usually 100-200 micrometers, it is required that it should have the minute laser spot of 10 micrometerphi extent, and should have high-speed responsibility as engine performance of a displacement sensor 83. Therefore, if it is going to guarantee the inspection precision while causing the fall of inspection precision, if it is not such a highly efficient displacement sensor 83, the problem of causing a cost rise will arise.
[0013] Moreover, it sets to the lead pin inspection approach of the IC package which uses the photogenic organ and the electric eye of the above-mentioned former, and they are two or more lead pin 80i. In order to measure with the case of a normal IC package the whole quantity of light which passes through between, they are two or more lead pin 80i. Even if it can judge the existence of the height gap which can be set, or a location gap, the amount of height gaps and the amount of location gaps of lead pin 80 the very thing which has a defect are immeasurable. Therefore, it has the defect in which the inspection based on the size judging of the amount of gaps is impossible, and highly precise inspection cannot be performed. Moreover, which lead pin 80i Whether it being easy to be generated by what kind of defect and analysis are also impossible, and the improvement of the approach of dealing with it based on the analysis, the storage approach, etc. cannot be aimed at, either.
[0014] Furthermore, in the position control approach which uses the above-mentioned conventional laser length measuring machine, since the laser length measuring machine 87 is expensive, there is a defect in which it becomes a cost rise. Moreover, in order that the reflective mirror 88 may be installed in sense in which a reflective laser beam carries out incidence to the laser length measuring machine 87 correctly and may hold the front face to the laser beam wavelength lambda to the mirror plane of lambda / precision of 2 - lambda/4, it also has the problem that the installation and management take great trouble, in actual use.
[0015] Then, this invention solves the technical problem of such a conventional technique, and aims at offering the positional controller which are a high speed, high degree of accuracy, and a low price, and

controls stably the lead pin test equipment which is a high speed, high degree of accuracy, and a low price, and inspects stably the defect of a location gap of a lead pin, a height gap, disappearance, a collective inclination, etc., and the relative location of two fields which meets.

[Translation done.]

* NOTICES *

MEANS

[Means for Solving the Problem] In the lead pin test equipment which inspects two or more lead pins which the above-mentioned technical problem set predetermined spacing, and aligned The light emitter and receiver which consists of an electric eye which receives the spot light from said projector which passed through between the stage in which an inspected object with two or more lead pins is carried, the projector which irradiates spot light with a predetermined include angle in the alignment side of two or more of said lead pins, and said two or more lead pins, The driving means which moves said light emitter and receiver or said stage in the alignment direction of two or more of said lead pins, A relative-speed-detector means to detect the relative passing speed of said light emitter and receiver by said driving means, and said stage, A time-of-day detection means to detect the shift time of day from an ON light condition to the protection-from-light condition of said electric eye, or the shift time of day from a protection-from-light condition to an ON light condition, An operation means to measure the amount of displacement from the normal location of each lead pin, or the number of deficits of a lead pin based on the shift time of day detected by the speed signal and said time-of-day detection means from said relative-speed-detector means, It is attained by the lead pin test equipment characterized by having a defective judging means to judge the existence of the defect in said two or more lead pins, based on the amount of displacement of each lead pin measured by said operation means, or the number of deficits of a lead pin.
[0017] Moreover, it replaces with said driving means and said relative-speed-detector means in the above-mentioned lead pin test equipment. It has the uniform driving means which makes the uniform migration of said light emitter and receiver or said stage carry out in the alignment direction of two or more of said lead pins. It is attained by the lead pin test equipment characterized by said operation means measuring the amount of displacement from the normal location of each lead pin, or the number of deficits of a lead pin based on the shift time of day detected by said time-of-day detection means.
[0018] Moreover, it replaces with said relative-speed-detector means in the above-mentioned lead pin test equipment. It has a distance detection means to detect the distance to the pin to be examined by which said projector irradiates spot light from the predetermined criteria location of said two or more lead pins. It is attained by the lead pin test equipment characterized by said operation means measuring the amount of displacement from the normal location of each lead pin, or the number of deficits of a lead pin based on the shift time of day detected by the distance signal and said time-of-day detection means from said distance detection means.
[0019] Moreover, it is attained in the above-mentioned lead pin test equipment by the lead pin test equipment characterized by having an amount storage means of measurement to memorize the amount of displacement of each lead pin measured by said operation means, or the number of deficits of a lead pin. Moreover, said projector is installed so that the point of two or more of said lead pins may be aslant irradiated to the alignment side of two or more of said lead pins, and it is attained in the above-mentioned lead pin test equipment by the lead pin test equipment characterized by to measure the amount of height gaps and the number of disappearance pins of the amount of location gaps of each lead pin in two or more of said lead pins and the number of disappearance pins, or each lead pin.

[0020] Moreover, in the above-mentioned lead pin test equipment, said projector is installed so that root Motobe of two or more of said lead pins may be irradiated almost perpendicularly to the alignment side of two or more of said lead pins, and it is attained by the lead pin test equipment characterized by measuring the number of disappearance pins in said two or more lead pins. Moreover, said 1st light emitter and receiver to which said light emitter and receiver irradiates almost perpendicularly the point of two or more of said lead pins to the alignment side of two or more of said lead pins in the above-mentioned lead pin test equipment, It has the 2nd light emitter and receiver which irradiates aslant the point of two or more of said lead pins to the alignment side of two or more of said lead pins, and is attained by the lead pin test equipment characterized by measuring the amount of location gaps and the amount of height gaps of each lead pin in said two or more lead pins.
[0021] Moreover, said 1st light emitter and receiver to which said light emitter and receiver irradiates almost perpendicularly the point of two or more of said lead pins to the alignment side of two or more of said lead pins in the above-mentioned lead pin test equipment, It has the 2nd light emitter and receiver which irradiates almost perpendicularly root Motobe of two or more of said lead pins to the alignment side of two or more of said lead pins, and is attained by the lead pin test equipment characterized by measuring the amount of inclinations in which said two or more lead pins incline in the alignment direction collectively.
[0022] Moreover, the projector with which said light emitter and receiver irradiates light in the above-mentioned lead pin test equipment in the alignment side of two or more of said lead pins, The optical system which condenses the light emitted from said projector and irradiates the spot light of predetermined magnitude at a position, It is arranged near the outer diameter of said spot light, is emitted from said projector, and is attained by the lead pin test equipment characterized by having two or more electric eyes which receive the light irradiated at a different include angle to the alignment side of two or more of said lead pins.
[0023] Moreover, it is attained in the above-mentioned lead pin test equipment by the lead pin test equipment characterized by preparing the linear member which transmits light to the front face of two or more of said electric eyes, respectively. Moreover, it is attained in the above-mentioned lead pin test equipment by the lead pin test equipment characterized by preparing the mask with which the detailed hole which penetrates the light from said projector was formed in the front face of said electric eye.
[0024] Moreover, it is attained in the above-mentioned lead pin test equipment by the lead pin test equipment characterized by preparing the mask with which the detailed hole which penetrates the light from said projector was formed in the front face of the linear member which transmits said light. Moreover, in the above-mentioned lead pin test equipment, it is on the straight line of said spot light which intersects a right angle mostly at the core, and the intensity of light emitted from said projector is attained by the lead pin test equipment characterized by having arranged said two or more electric eyes in the almost equal location.
[0025] Furthermore, it sets to the positional controller which controls the relative location of the 1st field and the 2nd field which meet. The projector fixed to said 1st field, and the electric eye fixed so that an optical axis might be in agreement when it was installed in said 2nd field and said the 1st field and said 2nd field became a predetermined relative location, By having the driving means to which the location of said 1st field or said 2nd field is changed, changing the relative location of said 1st and 2nd fields, and making in agreement the optical axis of said projector and said electric eye by said driving means It is attained by the positional controller characterized by controlling said the 1st field and said 2nd field to a predetermined relative location.
[0026] Moreover, it is the driving means which moves said the 1st field or said 2nd field in the fixed direction so that said driving means may change spacing of said 1st and 2nd fields in the above-mentioned positional controller. By changing a relative location with said 1st and 2nd fields, and making in agreement the optical axis of said projector and said electric eye by said driving means It is attained by the positional controller characterized by controlling the distance of the predetermined point of said 1st field, and the predetermined point of said 2nd field in a predetermined distance.
[0027] Moreover, they are two fields where said the 1st field and said 2nd field meet in parallel in the

above-mentioned positional controller. It is attained by the positional controller characterized by controlling the distance of said 1st field and said 2nd field in a predetermined distance by changing a relative location with said 1st and 2nd fields, and making in agreement the optical axis of said projector and said electric eye by said driving means.

[0028] Moreover, it consists of at least three projectors with which said projector has an optical axis in the different direction in the above-mentioned positional controller. Said electric eye consists of at least three electric eyes corresponding to said at least three projectors. Said driving means is a driving means to which the distance and the include angle of said 1st field and said 2nd field to make are changed. By changing a relative location with said 1st and 2nd fields, and making the optical axis of said at least three projectors and said at least three electric eyes in agreement, respectively by said driving means It is attained by the positional controller characterized by controlling the distance and the include angle of said 1st field and said 2nd field to make at a predetermined distance and a predetermined include angle.

[Translation done.]

* NOTICES *

OPERATION

[Function] In this invention, moving the stage in which the light emitter and receiver or the inspected object was carried in the alignment direction of two or more lead pins, spot light is irradiated with a predetermined include angle in the alignment side of two or more lead pins by ******, and the spot light which passed through between the lead pin is received by the electric eye. Therefore, the shift time of day from an ON light condition to the protection-from-light condition of an electric eye or the shift time of day from a protection-from-light condition to an ON light condition is detectable.
[0030] In two or more lead pins, when a certain lead pin is displacing from the normal location or is missing, it differs from shift time of day when the shift time of day from an ON light condition to the protection-from-light condition of an electric eye or the shift time of day from a protection-from-light condition to an ON light condition is normal. For this reason, the amount of displacement from the normal location of each lead pin or the number of deficits of a lead pin is correctly [easily and] measurable by detecting that variation and performing a predetermined operation. Therefore, based on these amounts of displacement, or the number of deficits, it becomes possible to judge the existence of the defect in two or more lead pins.

[Translation done.]

* NOTICES *

EXAMPLE

[Example] Hereafter, it explains based on the example illustrating this invention. Drawing 1 is a schematic diagram for explaining the lead pin test equipment of the brush which transmits a signal to the revolving shaft by the 1st example of this invention, and shows arrangement of 1 set of light emitters and receivers when seeing a subject-of-examination slack brush from a transverse plane, a side face, and a top face to each drawing 1 (a), (b), and (c), respectively. Moreover, drawing 2 is a block flow diagram which shows the circuitry which processes the output signal of an electric eye.
[0032] The brush 11 with which two or more lead pin 10i (i= 1, 2, --, n) is pulled out from the side face is carried on the transparence table 12 which penetrates light. Moreover, this transparence table 12 is lead pin 10i by the uniform driver (not shown). Uniform migration is carried out in the alignment direction. The **** projector 13 using semiconductor laser to irradiate is installed above this transparence table 12, and it is lead pin 10i. Spot light is irradiated with the predetermined include angle phi to an alignment side. Moreover, under the transparence table 12, the **** projector 13 is countered, for example, the **** electric eye 14 using a pin photodiode is installed, and it is lead pin 10i. The spot light from the **** projector 13 which passed through between is received. In this way, lead pin 10i 1 set of light emitters and receivers which face across an alignment side in between are arranged.
[0033] moreover, to this **** electric eye 14 The spot light from the **** projector 13 is lead pin 10i. The condition (ON light condition) which is passing through and carrying out ON light of the between to spot light is lead pin 10i. Time of day which shifts to an ON light condition from the time of day which shifts to the condition (protection-from-light condition) of being shaded, and a protection-from-light condition, That is, the time-of-day detector 15 which detects ON / off time of day Ti of the output signal of the **** electric eye 14, and (i= 1, 2, --, n) OFF/ON time-of-day T'i (i= 1, 2, --, n) is connected.
[0034] Moreover, in this time-of-day detector 15, it is lead pin 10i. The number counter 16 of pins, and ON / off time of day Ti which counts a number The ON / off time-of-day counter 17 to count, and OFF/ON time-of-day T'i OFF/ON time-of-day counter 18 to count is connected, respectively. Moreover, the amount arithmetic circuit 19 of height gaps which calculates amount of height gaps deltaZ is connected to the number counter 16 of pins, and the ON / off time-of-day counter 17, and the number arithmetic circuit 20 of disappearance pins which calculates disappearance pin several m of a lead pin is connected to ON / off time-of-day counter 17, and OFF/ON time-of-day counter 18.
[0035] Furthermore, while the number counter 16 of pins, the amount arithmetic circuit 19 of height gaps, and the number arithmetic circuit 20 of disappearance pins are connected to the amount store circuit 21 of measurement, the amount arithmetic circuit 19 of these height gaps and the number arithmetic circuit 20 of disappearance pins are connected to the defective judging circuit 22 which finally distinguishes the existence of the defect of a lead pin. Next, it explains using the timing diagram of the output signal of the electric eye which shows the case where amount of height gaps deltaZ of a lead pin is measured using the lead pin test equipment by the 1st example to the block flow diagram and drawing 3 of drawing 2 .
[0036] Now, as shown in drawing 3 , it is each lead pin 10i of a subject-of-examination slack brush. W

and its thickness are set to H and spacing which aligned normally is set to L for width of face. moreover, j-th lead pin 10j Two or more lead pin 10i a direction perpendicular to an alignment side -- facing down -- deltaZj only -- suppose that it has shifted. However, lead pin 10i There shall be no location gap in the alignment direction.

[0037] First, they are two or more lead pin 10i by the uniform driver (not shown) about this transparence table 12 after carrying a brush 11 on the transparence table 12. Rates [direction / alignment] Vo It is made to move. And spot light is irradiated from the **** projector 13 at coincidence. At this time, the spot light from the **** projector 13 is lead pin 10i. It is desirable to irradiate a point. It is because amount of height gaps deltaZ becomes large, so the direction of a point becomes easily [measurement] and exact. moreover, the spot light from the **** projector 13 -- lead pin 10i the include angle made to an alignment side, and the so-called illuminating angle phi -- lead pin 10i the amount of the maximum gaps to the height direction from an alignment side -- deltaZMAX ** -- if it carries out pi / 2> phi>tan -1 {(H+2 and deltaZMAX) /L} -- (1)

It is necessary to set up so that it may be satisfied. If it is because it will irradiate perpendicularly from the **** projector 13 and it becomes impossible to measure amount of height gaps deltaZ, when the illuminating angle phi becomes pi/2 and the illuminating angle phi becomes smaller than the range of the above-mentioned (1) formula, spot light is lead pin 10i. It is because the case where it becomes impossible to pass through between arises. However, it is more desirable for the smaller possible one, i.e., spot light, to irradiate from across within the limits of the above-mentioned (1) formula, when measuring amount of height gaps deltaZ.

[0038] In this way, the spot light from the **** projector 13 is lead pin 10i. While irradiating a point, it is lead pin 10i. The spot light which passed through between is received by the **** electric eye 14. And lead pin 10from ON light condition to **** electric eye 14 of spot light i Time of day which shifts to a protection-from-light condition according to the upper left hand corner (- shows in drawing 3 (a)), Namely, lead pin 10from ON/OFF time-of-day [of an output signal] Ti, and (- shows in drawing 3 (b)) protection-from-light condition i Time of day which shifts to an ON light condition according to a lower right angle (O shows in drawing 3 (a)), That is, the time-of-day detector 15 detects ON/OFF time-of-day T'i (O shows in drawing 3 (b)) of an output signal, and it is j-th lead pin 10j. ON/OFF time of day Tj to depend It counts with ON/OFF time-of-day counter 17.

[0039] Subsequently, several j, and ON / off time of day Tj from ON / off time-of-day counter 17 of the lead pin made into the object from the number counter 16 of pins in the amount arithmetic circuit 19 of height gaps It is based and is amount of height gaps deltaZj. It calculates. Namely, j-th lead pin 10j ON / off time of day Tj to depend Tj ={(W+L)x(j-1)+deltaZj/tan phi}/Vo+T1 -- (2)

Next door, therefore j-th lead pin 10j Amount of height gaps deltaZj deltaZj ={(Tj-T1) xVo-(W+L)x(j-1)} xtan phi -- (3)

It becomes.

[0040] Next, it explains using the timing diagram of the output signal of the electric eye which shows the case where disappearance pin several m of a lead pin is measured using the lead pin test equipment by the 1st example to the block flow diagram and drawing 4 of drawing 2 . Now, as shown in drawing 4 , it is j-th lead pin 10j. Suppose that m lead pins have disappeared from the degree.

[0041] Like the case where amount of height gaps deltaZ is measured, the subject-of-examination slack brush 11 is carried on the transparence table 12, and it is lead pin 10i by the uniform driver. Rates [direction / alignment] Vo Spot light is irradiated from the **** projector 13, making it move. And lead pin 10i The spot light which passed through between is received by the **** electric eye 14, and they are ON / off time of day Ti of the output signal of the **** electric eye 14. And OFF/ON time-of-day T'i The time-of-day detector 15 detects.

[0042] Subsequently, j-th lead pin 10j detected by the time-of-day detector 15 OFF/ON time-of-day T'j While counting with OFF/ON time-of-day counter 18, it is lead pin 10j. The following lead pin 10k The ON / off time of day Tk to depend It counts with ON / off time-of-day counter 17. Subsequently, it sets to the number arithmetic circuit 20 of disappearance pins, and is OFF/ON time-of-day T'j from OFF/ON time-of-day counter 18, and the ON / off time-of-day counter 17. And ON / off time of day Tk It is

based and disappearance pin several m is measured.
[0043] namely, -- if m disappearance pins exist -- j-th lead pin 10j OFF/ON time-of-day T'j from -- the following lead pin 10k The ON / off time of day Tk to depend up to -- deltabetween close light-hours T to the **** electric eye 14 -- long -- becoming -- deltaT=Tk-T'j = {(W+L) xm+L}/Vo -- (4)
It becomes. Therefore, disappearance pin several m m=(deltaTxVo-L)/(W+L)
= {(Tk-T'j) xVo-L} /(W+L) -- (5)
It becomes.
[0044] Amount of height gaps deltaZj of the lead pin measured as mentioned above And disappearance pin several m, while memorizing as data in the amount store circuit 21 of measurement, in the defective judging circuit 22, the final distinction about the defect of a lead pin based on such total quantity is made. Thus, it is lead pin 10i by the uniform driver about the brush 11 which transmits a signal to a revolving shaft according to the 1st example. It is a rate Vo to the alignment direction. Carrying out uniform migration It is lead pin 10i by the **** projector 13. A point is irradiated with phi to the alignment side whenever [predetermined acute-angle]. Lead pin 10i The spot light which passed through between is received by the **** electric eye 14. ON / off time of day Ti of the output signal of the **** electric eye 14 And OFF/ON time-of-day T'i The time-of-day detector 15 detects, respectively. Amount of height gaps deltaZ of a lead pin and disappearance pin several m are measurable by calculating based on (3) and (5) types in the amount arithmetic circuit 19 of height gaps, and the number arithmetic circuit 20 of disappearance pins. therefore, the defective judging circuit 22 -- amount of height gaps deltaZj of these lead pins and a ****** [that the target lead pin based on disappearance pin several m is a defect] -- judging -- two or more lead pin 10i Finally the existence of the defect of the lead pin which can be set can be distinguished.
[0045] At this time, it is amount of height gaps deltaZj of a lead pin. It reaches and disappearance pin several m is ON/OFF time of day Ti of the output signal of the **** electric eye 14. And OFF/ON time-of-day T'i Since it is measurable only with the based characteristic quantity, it is possible after conveyance migration of the brush 11 for inspection to obtain a judgment result at a high speed for a short time. moreover, amount of height gaps deltaZj of these lead pins and disappearance pin several m counting -- since an amount is memorized as data in the amount store circuit 21 of measurement, it becomes possible [presenting the analysis for improving a manufacture process, the handling approach, etc.].
[0046] Moreover, since it is possible to use comparatively cheap things, such as semiconductor laser and a pin photodiode, low-pricing is realizable for the **** projector 13 and the **** electric eye 14 also in cost. Moreover, since it is the optical system of a transparency mold, the light emitter and receiver which consists of a **** projector 13 and a **** electric eye 14 is lead pin 10i. The output signal stabilized from the **** electric eye 14 can be acquired without being dependent on a surface state. Therefore, lead pin 10i Measurement highly precise about the amount of displacement or the amount of deficits is attained, and the final distinction about the defect of a lead pin also becomes what has high dependability.
[0047] Moreover, it becomes possible by attaching a predetermined lens system, for example to semiconductor laser, and extracting the spot light of the **** projector 13 more minutely, and sampling the output signal of the **** electric eye 14 still at high speed to attain high-speed measurement with still higher resolution, therefore to raise highly-precise-izing in inspection, and high-speed-ization. In addition, it is lead pin 10i about the transparence table 12 which carried the brush 11 by the uniform driver in the 1st example of the above. Although the case where uniform migration was carried out was explained in the alignment direction This uniform migration is lead pin 10i. Since it is relative relation with 1 set of light emitters and receivers which consist of a **** projector 13 and a **** electric eye 14, it is lead pin 10i. Instead of moving the direction, uniform migration of the light emitter and receiver may be carried out.
[0048] Moreover, lead pin 10i of a brush 11 Since it is very small, width of face W and spacing L may be difficult to perform strict uniform migration. In such a case, it is lead pin 10i about the transparence table 12 instead of a uniform driver. What is necessary is just to install the relative-speed-detector sensor

which detects the driver which makes it move in the alignment direction, and the passing speed by the driver.

[0049] In this case, as the block flow diagram which shows the circuitry which processes the output signal of an electric eye is shown in drawing 5 , the relative-speed-detector sensor 23 will join the block flow diagram of drawing 2 , and the speed signal V in each time of day will be sent to the amount arithmetic circuit 19 of height gaps, and the number arithmetic circuit 20 of disappearance pins from this relative-speed-detector sensor 23. Therefore, it is [0050] instead of xVo [in / on the amount arithmetic circuit 19 of height gaps, and / (3) types (Tj-T1)].

[Equation 1]

$$\int_{T1}^{Tj} V \cdot dT$$

A ******** operation is made and it is j-th lead pin 10j. Amount of height gaps deltaZj [0051]

[Equation 2]

$$\Delta Zj = \left\{ \int_{T1}^{Tj} V \cdot dT - (W+L) \times (i-1) \right\} \times \tan \phi \quad \cdots (6)$$

It becomes. Moreover, it is [0052] instead of xVo [in / on the number arithmetic circuit 20 of disappearance pins, and / (5) types (Tk-T'j)].

[Equation 3]

$$\int_{T'j}^{Tk} V \cdot dT$$

A ******** operation is made and disappearance pin several m is [0053].

[Equation 4]

$$m = \left(\int_{T'j}^{Tk} V \cdot dT - L \right) \Big/ (W+L) \quad \cdots (7)$$

It becomes. furthermore, the thing for which a distance detection means is used instead of being based on the above rate information since both xVo in (3) and (5) types (Tj-T1) and xVo are the things showing a variation rate -- lead pin 10from a certain criteria location i up to -- lead pin 10i The distance of the alignment direction may be found.

[0054] In this case, the block flow diagram which shows the circuitry which processes the output signal of an electric eye As shown in drawing 6 , the distance detection sensor 24 joins the block flow diagram of drawing 2 . Instead of ON / off time-of-day counter 17, and OFF/ON time-of-day counter 18 ON / off time of day Ti Lead pin 10from predetermined criteria location i which can be set Distance Li to a left lateral the time of the ON/OFF to count -- a distance counter 25 and OFF/ON time-of-day T'i Lead pin 10from predetermined criteria location i which can be set Distance L'i to a right lateral At the time of the OFF/ON to count, it connects with the time-of-day detector 15 and the distance detection sensor 24, respectively, and a distance counter 26 is installed. Therefore, it sets to the amount arithmetic circuit 19 of height gaps. j-th lead pin 10j sent from a distance counter 25 Distance Lj to a left lateral It is based. (3) Instead of xVo in a formula (Tj-T1), Lj-L1 is used, an operation is made, and it is j-th lead pin 10j. Amount of height gaps deltaZj deltaZj ={(Lj-L1) -(W+L)x(i-1)} xtan phi -- (8)

It becomes.

[0055] Moreover, j-th lead pin 10j sent from a distance counter 26 in the number arithmetic circuit 20 of disappearance pins Distance L'j to a right lateral And lead pin 10k of the j-th degree sent from a distance counter 25 Distance Lk to a left lateral It is based. (5) Instead of xVo in a formula (Tk-T'j), Lk-L'j is used, an operation is made, and it is disappearance pin several m. m=(Lk-L'j-L)/(W+L) -- (9)
It becomes. Moreover, j-th lead pin 10j Distance Lj to a left lateral Lj =L'j-W -- (10)
Since come out and it is m= {(Lk-Lj) -(W+L)} /(W+L) -- (11)
You may carry out.
[0056] In addition, as a distance detection means at this time, a linear length measuring machine, a rotary encoder, the sending-out pulse count to a pulse motor, angle-of-rotation detection of a polygon mirror with a laser scan, etc. can specifically be considered. Moreover, it sets in the 1st example of the above, and they are two or more lead pin 10i. Although amount of height gaps deltaZ of a lead pin and disappearance pin several m were measured on the assumption that there was no location gap in the alignment direction, and the existence of the defect of a lead pin was distinguished Lead pin 10i If the manufacture approach of the brush 11 which it has, and the approach of dealing with it are caused how, it may not shift perpendicularly, but it may shift horizontally and a location gap may be produced.
[0057] Of course, it is possible to measure amount of location gaps deltaX using the lead pin test equipment by the 1st example of the above also in this case. However, in order to measure amount of height gaps deltaZ easily and correctly in the case of the 1st example of the above, it was made desirable whenever [illuminating-angle / of spot light] for phi to be small as much as possible within the limits of the above-mentioned (1) formula. However, when measuring amount of location gaps deltaX of a lead pin, in order to make the measurement easily and exact, it is desirable to make phi into a perpendicular or the include angle near it whenever [illuminating-angle / of spot light].
[0058] then -- next, two or more lead pin 10i The lead pin test equipment which measures amount of location gaps deltaX [of a lead pin] and disappearance pin several m on the assumption that there is no gap in the height direction from an alignment side is explained in full detail as the 2nd example. The lead pin test equipment of the brush which transmits a signal to the revolving shaft by the 2nd example of this invention is explained using drawing 7 and drawing 8 .
[0059] Drawing 7 (a), (b), and (c) are the schematic diagrams showing arrangement of 1 set of light emitters and receivers when seeing a subject-of-examination slack brush from a side face and a flat surface, respectively, and drawing 8 is a block flow diagram which shows the circuitry which processes the output signal of an electric eye. In addition, the same sign is given to the same component as the lead pin test equipment shown in above-mentioned drawing 1 and drawing 2 , and the explanation is omitted.

[0060] 1 set of light emitters and receivers which consist of the **** projectors 13 and the **** electric eyes 14 of the 1st example of the above in this 2nd example are lead pin 10i. 1 set of light emitters and receivers which consist of vertical illuminators 27 and perpendicular electric eyes 28 as shown in drawing 7 are lead pin 10i to being aslant arranged to an alignment side. The description is perpendicularly arranged to the alignment side.
[0061] In addition, in the circuitry which processes the output signal of an electric eye, if it removes that the amount arithmetic circuit 29 of location gaps is formed instead of the amount arithmetic circuit 19 of height gaps as shown in drawing 8 , it is the same as that of the case of the 1st example of the above almost. Next, it explains using the timing diagram of the output signal of the electric eye which shows the case where amount of location gaps deltaX of a lead pin is measured using the lead pin test equipment by the 2nd example to the block flow diagram and drawing 9 of drawing 8 .
[0062] now, it is shown in drawing 9 (a) -- as -- a subject of examination -- j-th lead pin 10j of lead pin 10i of a brush 11 Lead pin 10i the sense contrary to the sense which a brush 11 moves in the alignment direction -- deltaXj only -- it shall have shifted and there shall be no height gap from the alignment side It is lead pin 10i like the case of the 1st example of the above about the transparence table 12 which carried the brush 11 by the uniform driver. Rates [direction / alignment] Vo Spot light is irradiated from vertical illuminator 27, making it move. At this time, the spot light from vertical illuminator 27 is lead pin 10i. One with desirable irradiating a point is lead pin 10i, although it is the same as that of the

case of the 1st example of the above. phi greatly differs whenever [illuminating-angle / of the spot light from vertical illuminator 27 to an alignment side].
[0063] Namely, lead pin 10i It is phi whenever [illuminating-angle / of the spot light from vertical illuminator 27 to an alignment side]. Phi=pi/2 -- (12)
Come out, and it is, therefore spot light is lead pin 10i. It irradiates perpendicularly. However, what is necessary is for this include angle not to be strict and just to irradiate it at a perpendicularly near include angle.
[0064] In this way, the spot light from vertical illuminator 27 is lead pin 10i. While irradiating a point, it is lead pin 10i. The spot light which passed through between is received by the perpendicular electric eye 28. And the shift time of day from an ON light condition to the protection-from-light condition to the electric eye 27 of spot light and the shift time of day ti from a protection-from-light condition to an ON light condition, i.e., ON / off time of day of an output signal, And ON / off time-of-day t'i The time-of-day detector 15 detects and it is j-th lead pin 10j. The ON / off time of day tj to depend It counts with ON / off time-of-day counter 17.
[0065] Subsequently, several j, and ON / off time of day tj from ON / off time-of-day counter 17 of the lead pin made into the object from the number counter 16 of pins in the amount arithmetic circuit 29 of location gaps It is based and is amount of location gaps deltaXj. It calculates. Namely, j-th lead pin 10j ON / off time of day tj tj ={(W+L)x(j-1)+deltaXj}/Vo+t1 -- (13)
Next door, therefore j-th lead pin 10j Amount of location gaps deltaXj deltaXj = {(tj-t1) xVo-(W+L)x (j-1)} -- (14)
It becomes.
[0066] In addition, it is almost the same as the case in the 1st example of the above, therefore the actuation which measures disappearance pin several m of a lead pin with the lead pin test equipment by the 2nd example is disappearance pin several m. m= {(tk-t'j) xVo-L} /(W+L) -- (15)
It becomes.
[0067] Amount of location gaps deltaXj of the lead pin measured as mentioned above And disappearance pin several m, while memorizing as data in the amount store circuit 21 of measurement, in the defective judging circuit 22, the final distinction about the defect of a lead pin based on such total quantity is made. Thus, it is lead pin 10i by the uniform driver about the brush 11 which transmits a signal to a revolving shaft according to the 2nd example. Rates [direction / alignment] Vo Making it move It is lead pin 10i by vertical illuminator 27. A point is perpendicularly irradiated to the alignment side. Lead pin 10i The spot light which passed through between is received by the perpendicular electric eye 28. ON / off time of day ti of the output signal of the perpendicular electric eye 28 And the time-of-day detector 15 detects OFF/ON time-of-day t'i. Amount of location gaps deltaX [of a lead pin] and disappearance pin several m is measurable by calculating based on (14) and (15) types in the amount arithmetic circuit 29 of location gaps, and the number arithmetic circuit 20 of disappearance pins.
[0068] Therefore, amount of location gaps deltaX [of these lead pins], and disappearance pin several m, while memorizing as data in the amount store circuit 21 of measurement, finally in the defective judging circuit 22, the existence of the defect of a lead pin can be distinguished based on such total quantity. In addition, as the 1st example of the above was described, it is lead pin 10i. Instead of moving the direction, uniform migration of the light emitter and receiver may be carried out. Moreover, a driver and a relative-speed-detector sensor may be installed instead of a uniform driver. Furthermore, a distance detection means may be used.
[0069] However, in order to measure amount of location gaps deltaX easily and correctly in the 2nd example of the above, spot light is lead pin 10i. It is made desirable to irradiate a point. However, it differs from the case where it shows in above-mentioned drawing 7 in measuring disappearance pin several m of a lead pin, and spot light is lead pin 10i. It is desirable to irradiate root Motobe.
[0070] For example, as shown in drawing 10 (a), a location gap of a lead pin is very large, and the spacing A of the lead pin in a point A - 2 L+W -- (16)
When having become and spot light irradiates the point of a lead pin, as shown in drawing 10 (b), there is a possibility of taking for the case where the lead pin has disappeared. On the other hand, when root

Motobe of a lead pin is irradiated, the spacing a of the lead pin in root Motobe is even if it is a however big location gap. a<2 L+W -- (17)
Since it becomes, there is no possibility of taking for the lead pin having disappeared. Therefore, in order to measure disappearance pin several m of a lead pin, to be stabilized and to distinguish the existence, spot light is lead pin 10i. It is desirable to irradiate root Motobe.
[0071] Moreover, it sets to one side and the 1st and 2nd examples of the above are lead pin 10i. Amount of height gaps deltaZ and disappearance pin several m are measured for there being no location gap as a premise. It sets on another side and is lead pin 10i. Amount of location gaps deltaX and disappearance pin several m is measured on the assumption that there is no height gap, but it is not few also when **, location gap, and height gap of an IC package like a lead pin compound and arise, for example.
[0072] Then, next, the thing to carry out to that phi is an acute angle as much as possible within the limits of the above-mentioned (1) formula whenever [illuminating-angle / of spot light], a perpendicular, or the include angle near it, A demand which is [irradiate / that spot light irradiates the point of a lead pin and root Motobe] different is satisfied. The lead pin test equipment which can measure the variation rate which the location gap and the height gap compounded, and can measure further the collective amount of inclinations of the lead pin which was impossible for measurement in the 1st and 2nd examples of the above is explained in full detail as the 3rd example.
[0073] Next, the lead pin test equipment of the IC package by the 3rd example of this invention is explained using drawing 11 and drawing 12 . Drawing 11 (a) and (b) are the schematic diagrams showing arrangement of 3 sets of light emitters and receivers when seeing a subject-of-examination slack IC package from a side face and a flat surface, respectively, and drawing 12 is a block flow diagram which shows the circuitry which processes the output signal of an electric eye.
[0074] IC package 31 by which two or more lead pin 30i (i= 1, 2, --, n) is pulled out from each side face is carried on the transparence table 32 which penetrates light. And this transparence table 32 is lead pin 30i by the uniform driver (not shown). Uniform migration is carried out in the alignment direction. Moreover, the 1st vertical illuminator 33 which irradiates spot light, respectively, the **** projector 34, and the 2nd vertical illuminator 35 are installed above the transparence table 32. The 1st vertical illuminator 33 of them is lead pin 30i. A point is irradiated almost perpendicularly to the alignment side. The **** projector 34 is lead pin 30i. Irradiating a point with the predetermined include angle phi to the alignment side, the 2nd vertical illuminator 35 is lead pin 30i. Root Motobe is irradiated almost perpendicularly to the alignment side. Moreover, the 1st vertical illuminator 33 and 2nd vertical illuminator 35 are that installation top and lead pin 30i at this time. Only distance b is separated in the alignment direction.
[0075] Furthermore, under the transparence table 32, the 1st vertical illuminator 33, the **** projector 34, and the 2nd vertical illuminator 35 are faced, the 1st perpendicular electric eye 36, the **** electric eye 37, and the 2nd perpendicular electric eye 38 are installed, respectively, and it is lead pin 30i. The spot light from the 1st vertical illuminator 33 which passed through between, the **** projector 34, and the 2nd vertical illuminator 35 is received, respectively. In this way, lead pin 30i 3 sets of light emitters and receivers which face across an alignment side in between are arranged.
[0076] moreover, to the perpendicular electric eye 36 of these 1st, the **** electric eye 37, and the 2nd perpendicular electric eye 38 Lead pin 30from ON light condition of spot light from 1st vertical illuminator 33, **** projector 34, and 2nd vertical illuminator 35 i Shift time of day to the protection-from-light condition to depend, or shift time of day from a protection-from-light condition to an ON light condition, Namely, ON / off time of day ti of the output signal of the 1st perpendicular electric eye 36, the **** electric eye 37, and the 2nd perpendicular electric eye 38, Ti, taui and (i= 1, 2, --, n) OFF/ON time-of-day t'i, T'i, tau'i (i= 1, 2, --, n) The time-of-day detectors 39, 40, and 41 to detect are connected, respectively.
[0077] Moreover, in the time-of-day detector 39, it is lead pin 30i. The number counter 42 of pins, and ON / off time of day ti which also counts a number The ON / off time-of-day counter 43 to count are connected. In the time-of-day detector 40, they are ON / off time of day Ti. The ON / off time-of-day counter 44 to count are connected. In the time-of-day detector 41 The ON / off time-of-day counter 45,

and OFF/ON time-of-day tau'i which count ON / off time-of-day taui OFF/ON time-of-day counter 46 to count is connected.
[0078] moreover, to ON / off time-of-day counter 43, and the number counter 42 of pins The amount arithmetic circuit 47 of location gaps which calculates amount of location gaps deltaX is connected. To ON / off time-of-day counter 44, and the number counter 42 of pins The amount arithmetic circuit 48 of height gaps which calculates amount of height gaps deltaZ is connected. To ON / off time-of-day counter 43, and the ON / off time-of-day counter 45 Collective amount of inclinations deltaXs of a lead pin The amount arithmetic circuit 49 of inclinations to calculate is connected, and the number arithmetic circuit 50 of disappearance pins which calculates disappearance pin several m of a lead pin is connected to ON / off time-of-day counter 45, and OFF/ON time-of-day counter 46.
[0079] Furthermore, while the number counter 42 of pins, the amount arithmetic circuit 47 of location gaps, the amount arithmetic circuit 48 of height gaps, the amount arithmetic circuit 49 of inclinations, and the number arithmetic circuit 50 of disappearance pins are connected to the total quantity store circuit 51, the amount arithmetic circuit 47 of these locations gaps, the amount arithmetic circuit 48 of height gaps, the amount arithmetic circuit 49 of inclinations, and the number arithmetic circuit 50 of disappearance pins are connected to the defective judging circuit 52 which finally distinguishes the defect of a lead pin.
[0080] Next, it explains using the timing diagram of the output signal of the electric eye which shows the case where amount of location gaps deltaX of a lead pin and amount of height gaps deltaZ are measured using the lead pin test equipment by the 3rd example to the block flow diagram and drawing 13 of drawing 12 . Now, as shown in drawing 13 (a), it is each lead pin 30i of IC package 31 as a subject of examination. Width of face W, the thickness -- H and spacing which aligned normally -- L -- carrying out -- j-th lead pin 30j Lead pin 30i the sense contrary to the sense which IC package 31 moves in the alignment direction -- deltaXj only -- shifting -- the still more nearly perpendicular direction from the alignment side -- facing down -- deltaZj only -- suppose that it has shifted.
[0081] First, they are two or more lead pin 30i by the uniform driver (not shown) about this transparence table 32 after carrying subject-of-examination slack IC package 31 on the transparence table 32. Rates [direction / alignment] Vo Spot light is irradiated from the 1st vertical illuminator 33 and **** projector 34, making it move. And the spot light from these 1st vertical illuminators 33 and the **** projector 34 is lead pin 30i. While irradiating a point, it is lead pin 30i. It passes through between and ON light is carried out to the 1st perpendicular electric eye 36 and **** electric eye 37.
[0082] And lead pin 30from ON light condition to 1st perpendicular electric eye 36 of spot light irradiated almost perpendicularly from 1st vertical illuminator 33 like case of 2nd example of the above i Shift time of day to the protection-from-light condition to depend, and shift time of day from a protection-from-light condition to an ON light condition, Namely, ON / off time of day ti of an output signal And OFF/ON time-of-day t'i The time-of-day detector 39 detects and it is j-th lead pin 30j. The ON / off time of day tj to depend It counts with ON / off time-of-day counter 43.
[0083] Moreover, lead pin 30from ON light condition to 2nd electric eye 37 of spot light irradiated with predetermined include angle phi like case of 1st example of the above from **** projector 34 i Shift time of day to the protection-from-light condition by the upper left hand corner (- shows in drawing 13 (a)), Namely, lead pin 30from ON/OFF time-of-day [of an output signal] Ti, and (- shows in drawing 13 (c)) protection-from-light condition i Shift time of day to the ON light condition by the lower right angle (O shows in drawing 13 (a)), Namely, ON/OFF time of day Tj the time-of-day detector 40 detects OFF/ON time-of-day T'i (- shows in drawing 13 (c)) of an output signal, and according to j-th lead pin 30j It counts with ON/OFF time-of-day counter 44.
[0084] Subsequently, the ON / off time of day tj from several j, and the ON / off time-of-day counters 43 and 44 of the lead pin made into the object from the number counter 42 of pins in the amount arithmetic circuit 47 of location gaps, and the amount arithmetic circuit 48 of height gaps, and Tj It is based and is amount of location gaps deltaXj. And amount of height gaps deltaZj It calculates. Namely, j-th lead pin 30j The ON / off time of day tj to depend, and Tj tj ={(W+L)x(j-1)+deltaXj}/Vo+t1 -- (18)
Tj ={(W+L)x(j-1)+deltaXj+deltaZj/tan phi}/Vo+T1 -- (19)

Next door, therefore j-th lead pin 30j Amount of location gaps deltaXj deltaXj = {(tj-t1) xVo-(W+L)x (j-1)} -- (20)
A next door and amount of height gaps deltaZj deltaZj ={(Tj-T1) xVo-(W+L)x(j-1)-deltaXj} xtan phi = {(Tj-T1) xVo-(tj-t1) xVo} xtan phi -- (21)
It becomes.
[0085] Next, the lead pin test equipment by the 3rd example is used, and it is collective amount of inclinations deltaXs of a lead pin. Lead pin 30i which shows the case where it measures to the block flow diagram and drawing 14 of drawing 12 It explains using an expansion top view. Now, as shown in drawing 14 , it is lead pin 30i of IC package 31. Suppose that the uniform location gap is produced altogether. Since it is undetectable depending on the 1st perpendicular electric eye 36 and **** electric eye 37 in the 1st vertical illuminator 33 and **** projector 34 list, such a collective inclination is lead pin 30i. It detects using the 1st and 2nd perpendicular electric eyes 36 and 38 corresponding to the 1st and 2nd vertical illuminators 33 and 35 and these which irradiate a point and root Motobe almost perpendicularly to the alignment side.
[0086] It is lead pin 30i about the transparence table 32 which carried subject-of-examination slack IC package 31 like the case where amount of location gaps deltaX and amount of height gaps deltaZ is measured. Rates [direction / alignment] Vo Spot light is irradiated from the 1st and 2nd vertical illuminators 33 and 35, making it move. And the shift time of day from an ON light condition to the protection-from-light condition to the 1st perpendicular electric eye 36 of the spot light from the 1st vertical illuminator 33, Namely, ON / off time of day ti of the output signal of the 1st perpendicular electric eye 36 Shift time of day from an ON light condition to the protection-from-light condition to the 2nd perpendicular electric eye 38 of the spot light from the 2nd vertical illuminator 35, Namely, ON / off time-of-day taui of the output signal of the 2nd perpendicular electric eye 38 The time-of-day detectors 39 and 41 detect, respectively, and it counts with ON / off time-of-day counters 43 and 45.
[0087] Subsequently, it sets to the amount arithmetic circuit 49 of inclinations, and they are the ON / off time of day ti from ON / off time-of-day counters 43 and 45, and taui. It is based and the amount of inclinations is calculated like the case of the 1st example of the above. Here, it is lead pin 30i. Distance deltaXs of the alignment direction from root Motobe to a point Lead pin 30i If it is the collective amount of inclinations, it is amount of inclinations deltaXs. deltaXs =(ti-taui) xVo-b -- (22)
however, i= -- it is set to 1, 2, --, n.
[0088] Next, disappearance pin several m of a lead pin is measured using 1 set of light emitters and receivers which consist of the 2nd vertical illuminator 35 in the lead pin test equipment by the 3rd example, and the 2nd perpendicular electric eye 38. The actuation in this case is lead pin 30i. It is almost the same as a case [in / the difference in whether root Motobe is irradiated or a point is irradiated, and / in others / the 2nd example of the above]. [that] Therefore, disappearance pin several m m= {(tauk - tau'j) xVo-L} /(W+L) -- (23)
It becomes.
[0089] Amount of location gaps deltaXj of the lead pin measured as mentioned above, amount of height gaps deltaZj, collective amount of inclinations deltaXs, and disappearance pin several m, while memorizing as data in the total quantity store circuit 51, in the defective judging circuit 52, the final distinction about the defect of a lead pin based on such total quantity is made. Thus, according to the 3rd example, it is lead pin 30i about IC package 31 by the uniform driver. Rates [direction / alignment] Vo Making it move It is lead pin 30i by the 1st vertical illuminator 33. A point is irradiated almost perpendicularly to the alignment side. It is lead pin 30i by the **** projector 34. A point is irradiated with the predetermined include angle phi to the alignment side. It is lead pin 30i by the 2nd vertical illuminator 35. Root Motobe is irradiated almost perpendicularly to the alignment side. Lead pin 30i ON / off time of day ti of the output signal of the 1st perpendicular electric eye 36 which received the spot light from the 1st vertical illuminator 33 which passed through between, the **** projector 34, and the 2nd vertical illuminator 35, respectively, the **** electric eye 37, and the 2nd perpendicular electric eye 38, and Ti, taui And OFF/ON time-of-day t'i, T'i, tau'i The time-of-day detectors 39, 40, and 41 detect, respectively. By calculating based on (20) - (23) type in the amount arithmetic circuit 47 of

location gaps, the amount arithmetic circuit 48 of height gaps, the amount arithmetic circuit 49 of inclinations, and the number arithmetic circuit 50 of disappearance pins Amount of location gaps deltaX of a lead pin, amount of height gaps deltaZ, collective amount of inclinations deltaXs, and disappearance pin several m are measurable, respectively.

[0090] Therefore, amount of location gaps deltaX of these lead pins and amount of height gaps deltaZ, collective amount of inclinations deltaXs, and disappearance pin several m, while memorizing as data in the total quantity store circuit 51, finally in the defective judging circuit 52, the defect of a lead pin can be distinguished based on such total quantity. In addition, in the 3rd example, uniform migration of 3 sets of light emitters and receivers may be carried out instead of carrying out uniform migration of the transparence table 32 which carried IC package 31 by the uniform driver like the case of the 1st and 2nd examples of the above.

[0091] Moreover, it is lead pin 30i about the transparence table 32 instead of a uniform driver. The relative-speed-detector sensor which detects the passing speed by the driver which makes it move in the alignment direction, and its driver may be installed. Moreover, based on distance information, amount of location gaps deltaXj of a lead pin, amount of height gaps deltaZj, and disappearance pin several m may be measured by using distance detection means, such as a linear length measuring machine, instead of rate information.

[0092] Next, the lead pin test equipment of the IC package by the 4th example of this invention is explained using drawing 15 thru/or 17. Drawing 15 is the principle explanatory view of this example, and drawing 16 is drawing showing the example used as a light-emitter-and-receiver unit based on the principle of this example shown in drawing 15 . Drawing 17 is drawing explaining the inspection approach of lead pin deflection.

[0093] Although two or more pairs of light-emitter-and-receiver units from which an illuminating angle differs by making one projector and one electric eye into a pair were used in the 3rd example mentioned above, it constitutes from this example as a light-emitter-and-receiver unit which prepared two or more electric eyes to one projector. The principle explanatory view of drawing 15 shows the case where two electric eyes are used to one projector.

[0094] IC package 104 which is a subject of examination and by which two or more lead pins 106 are pulled out from each side face is carried on the transparence table 108 which penetrates light. The projector 100 which irradiates light is formed above the transparence table 108, and the optical system which makes a subject the lens 102 which condenses the light from a projector 100 is prepared in the lower part of a projector 100.

[0095] Two electric eyes 110 are installed in the include-angle theta direction to optical-axis Z-Z' of a projector 100 by the lower part of the transparence table 108. It is condensed by the optical system which makes a lens 102 a subject, and the light emitted from the projector 100 turns into light which has the breadth of an include angle theta to optical-axis Z-Z' of a projector 100. The light which carried out incidence aslant at an angle of theta to IC package 104 passes through between the lead pins 106, and it carries out incidence to an electric eye 110.

[0096] Thus, the light which carries out incidence to the electric eye 110 on either side is irradiated at a mutually different include angle to IC package 104. Therefore, light with a different illuminating angle is realizable with one projector 100. It unites with the support frame 120 which carried out the shape of a typeface of one projector 100 and four electric eyes 112, 114, 116, and 118KO, and the light-emitter-and-receiver unit of the lead pin test equipment by this example is formed, as shown in drawing 16 . Four electric eyes 112, 114, 116, and 118 are arranged on two straight lines of the spot 124 condensed by optical system 122 which go direct in the center mostly, X-X', and Y-Y'. Moreover, IC package 104 to inspect is placed between optical system 122 and two or more electric eyes 112, 114, 116, and 118. In addition, although IC package 104 was put on the transparence table 108, only IC package 104 was illustrated here for simplification.

[0097] The alignment direction of the lead pin 106 of IC package 104 to inspect is now doubled in the direction of Y-Y', and the direction of relative motion is also made into the direction (the direction of an arrow head in drawing) of Y-Y'. At this time, since the light which carried out incidence to electric eyes

112 and 114 is deflected in the perpendicular direction to the direction of relative motion, it can be considered to the lead pin 106 that it is vertical-incidence light. Moreover, since the light which carried out incidence to electric eyes 116 and 118 is deflected in the direction of relative motion, it can be considered to the lead pin 106 that it is oblique-incidence light.

[0098] Thus, the function same with using the light-emitter-and-receiver unit of two perpendicular directions and the light-emitter-and-receiver unit of the two directions of slant can be obtained by using the light-emitter-and-receiver unit by this example. Therefore, as shown in the 3rd example of the above, the amount of location gaps, the amount of height gaps, the collective amount of inclinations, and the number of disappearance pins of the lead pin 106 are measurable.

[0099] Next, measurement of lead pin deflection is explained as an example of the measurement in this example. As shown in drawing 17 , when the lead pin 106 which has the deflection of the include angle of alpha in the direction of X-X' is a subject of examination, if the lead pin 106 moves in the direction of Y[from Y] ', the light which carries out incidence to an electric eye 114 will be interrupted when the lead pin 106 reaches at an A point, but the light which carries out incidence to an electric eye 112 does not interrupt light until the lead pin 106 reaches at a B point. This can be used and corner of a street alpha of a lead pin and pin disappearance can be searched for from count by detecting the distance of an A point and a B point using the relative-speed-detector sensor 23 or the distance detection sensor 24.

[0100] Thus, according to this example, all inspection of a lead pin is possible by the light-emitter-and-receiver unit constituted by the projector of a piece, and two or more electric eyes. Moreover, since a series of inspection in one light-emitter-and-receiver unit is possible, an attachment tooth space is reducible. Furthermore, since the distance between four electric eyes can be contracted, the migration length of the lead pin at the time of inspecting also becomes short, and can shorten the inspection processing time.

[0101] In addition, although the direct electric eye 110 had received the light emitted from the projector 100 in the light-emitter-and-receiver unit shown in drawing 15 , as shown in drawing 18 , two or more linear members 156 which transmit light, such as an optical fiber, may be arranged, and a light-receiving function may be further given by the thing [connecting an electric eye 110 previously]. Moreover, as shown in drawing 19 , the mask 160 which a detailed hole 158 like a pinhole opened ahead of the linear member 156 which transmits light, such as an electric eye or an optical fiber, may be arranged, the intensity of light which receives light may be adjusted, or invasion of disturbance light may be prevented and stabilization of a light-receiving function may be achieved.

[0102] Moreover, in the light-emitter-and-receiver unit of drawing 15 , although the electric eye 110 has been arranged on the same periphery, as long as the intensity of light is an almost equal point, you may arrange not only a periphery top but on the periphery of other configurations, such as an ellipse. Next, the lead pin test equipment of the IC package by the 5th example of this invention is explained using drawing 20 thru/or 24.

[0103] Drawing 20 is the principle explanatory view of this example. Drawing 21 is a schematic diagram explaining the lead pin test equipment by this example, and drawing 22 is a block flow diagram which shows the digital disposal circuit of lead pin test equipment. Drawing 23 and drawing 24 are the explanatory views of the lead pin test equipment shown in drawing 21 of operation. In the 4th example mentioned above, one light-emitter-and-receiver unit shown in drawing 16 showed that lead pin inspection was possible. In the lead pin test equipment of this example, the bidirection which is another advantage of the light emitter and receiver shown in drawing 16 is used.

[0104] The principle of this example is explained using drawing 20 . Drawing 20 (a) shows the principle when, as for drawing 20 (b), the lead pin 106 moves a principle when the lead pin 106 moves to the right from the left to the left from the right. In addition, Y-Y' in drawing supports the notation of drawing 16 . When the lead pin 106 is moved to the left from the right, the light which the light which carries out incidence to an electric eye 116 is interrupted in the inferior-surface-of-tongue edge B point of the lead pin 106, and carries out incidence to an electric eye 118 is interrupted in the top-face edge A point of the lead pin 106. When a lead pin is moved to the right from the left, the light which the light which carries out incidence to an electric eye 118 is interrupted at the inferior-surface-of-tongue edge C point of the

lead pin 106, and carries out incidence to an electric eye 116 is interrupted at the top-face edge D point of the lead pin 106.
[0105] Since unifying is desirable as for the detection side (a top face or inferior surface of tongue) of the lead pin 106 in case the lead pin 106 is inspected, when it has only one electric eye in the direction of Y-Y', the migration direction of the lead pin 106 is limited to a right one direction from the left or the left from the right. However, the lead pin 106 becomes possible [moving to right-and-left both directions] by arranging two electric eyes. However, it is necessary to choose the electric eye 116 detected according to the migration direction, or 118 in that case. That is, what is necessary is to detect an A point using an electric eye 118, in case it moves leftward, and just to detect D point using an electric eye 116, in case it moves rightward when the top face of the lead pin 106 is made into a detection side.
[0106] The lead pin test equipment by this example is explained using drawing 21 . Drawing 21 (a) and (b) show the plan and side elevation of lead pin equipment, respectively. On the slide guide 130 fixed to the foundation 128, the slide table 132 which moves to right and left is formed. Four light-emitter-and-receiver units 134, 136, 138, and 140 for inspecting the lead pin 106 are formed in the slide table 132. In addition, the light-emitter-and-receiver units 134, 136, 138, and 140 are shown in drawing 16 . Moreover, the work-piece susceptor 152 for putting IC package 104 to inspect between the projector 110 of the light-emitter-and-receiver units 134, 136, 138, and 140 and electric eyes 112, 114, 116, and 118 is arranged.
[0107] The transfer robot 142 which conveys IC package 104 is attached in the gastrostyle 144 fixed to the foundation 128, and rotates focusing on a gastrostyle 144. Moreover, four arms 146 with which the IC chuck 148 was attached at the tip and which intersect a right angle are prepared for the transfer robot 142, and four IC packages 104 can be carried to coincidence.
[0108] Moreover, vertical migration is possible for a gastrostyle 144, as shown in drawing 21 (b), in case IC package 104 is gripped or released, it moves downward, and in case a transfer robot is rotated, it moves upwards. The circuitry which processes the output signal of the light-emitter-and-receiver units 134, 136, 138, and 140 is explained using drawing 22 .
[0109] The time-of-day detectors 39 and 41 are connected to the 1st perpendicular electric eye 112 of each light-emitter-and-receiver unit, and the 2nd perpendicular electric eye 114, respectively. Moreover, the 1st **** electric eye 116 and the 2nd **** electric eye 118 are connected to the time-of-day detector 40 through the change machine 162. The change machine 162 serves to change which [of electric eyes 116 and 118] is connected to the time-of-day detector 40 based on a change signal.
[0110] Since it is the same as that of the 3rd example about others, explanation is omitted. Next, actuation of the lead pin test equipment of this example is explained using drawing 21 **** 24. Drawing 23 shows actuation of the both-way slide table 132 in the case of lead pin inspection, and drawing 24 is drawing showing the location of the lead pin at the time of IC package 104 being carried by the transfer robot 142.
[0111] Suppose that IC package 104 of the square which has a lead pin in four sides as shown in drawing 24 now is inspected. IC package 104 is supplied to the supply stage 150, where the index mark 164 which shows arrangement of the lead pin 106 is made into the lower left. IC package 104 supplied to the supply stage 150 is carried by the transfer robot 142 at the A point of the work-piece susceptor 152. An A point is in the location of 90 degrees from the supply stage 150 focusing on the transfer robot's 142 gastrostyle 144. That is, 90 degrees of IC packages 104 supplied on the supply stage 150 rotate by moving to an A point, and they move the index mark 164 of IC package 104 to the upper left.
[0112] What is necessary is just to move rightward the both-way slide table 132 in the location shown in drawing 23 (a), in order to inspect IC package 104 placed at the A point. This conducts lead pin inspection of two sides of upper and lower sides of IC package 104 using the light-emitter-and-receiver units 134 and 136. That is, the 1st lead pin train 166 and the 2nd lead pin train 168 are inspected by the light-emitter-and-receiver units 134 and 136, respectively.
[0113] Termination of the inspection in an A point carries IC package 104 from the A point of the work-piece susceptor 152 with the transfer robot 142 at the B point of the work-piece susceptor 152.

Similarly, a B point is in the location of 90 degrees from an A point focusing on the transfer robot's 142 gastrostyle 144. For this reason, 90 more degrees of IC packages 104 rotate, and they move an index mark to the upper right. Moreover, the 1st lead pin train 166 and the 2nd lead pin train 168 which were inspected in the A point serve as right-hand side of IC package 104, and left-hand side, respectively.
[0114] By the above-mentioned inspection, the both-way slide table 132 will move to the right-hand side of a slide guide 130, and as shown in drawing 23 (b), the light-emitter-and-receiver units 138 and 140 will be located in the right-hand side of a B point. Therefore, what is necessary is just to move the both-way slide table 132 leftward shortly, in order to inspect IC package 104 placed at the B point. This conducts lead pin inspection of remaining two sides of IC package 104 using the light-emitter-and-receiver units 138 and 140. That is, the 3rd lead pin train 170 and the 4th lead pin train 172 are inspected by the light-emitter-and-receiver units 138 and 140, respectively.
[0115] In addition, since it is necessary to change the electric eyes 116 and 118 of the **** direction in case the migration direction of the both-way slide table 130 is made reverse, as mentioned above, the electric eye of the **** direction connected to the time-of-day detector 40 using the change machine 162 is changed. After the inspection in a B point is completed, IC package 104 is taken out from the B point of the work-piece susceptor 152 with the transfer robot 142, is carried to a stage 154, and ends an inspection process here.
[0116] Moreover, in a series of above-mentioned procedures, it is possible to inspect to coincidence IC package 104 which is different in the A point and B point of the work-piece susceptor 152. Thus, according to this example, the light-emitter-and-receiver unit of a lot with the projector of a piece and two or more electric eyes does not need to fix the migration direction over the lead pin alignment direction by changing two **** electric eyes. For this reason, when it uses as lead pin test equipment as shown in drawing 21 , it is not necessary to return the both-way slide table 132 at every inspection, and inspection time amount can be shortened.
[0117] Next, the positional controller which controls the relative location of two fields by the 6th example of this invention is explained using drawing 25 . Drawing 25 (a) and (b) are the schematic diagrams showing arrangement of 1 set of light emitters and receivers when seeing the field of two controlled-system slack from a side face, respectively, and drawing 25 (c) is the timing diagram of the output signal of the electric eye of the positional controller.
[0118] As shown in drawing 25 (a), two fields of the Ath page and the Bth page set a certain spacing, and have met in parallel. And the optical system 60 to which the television camera etc. is connected is being fixed to the Ath page, and, as for the point of the optical system 60, only distance d has projected caudad from the Ath page. Moreover, from the normal stood to the Ath page, the projector 61 which irradiates spot light leans only an include angle phi to the Ath page, and is being fixed to it.
[0119] The electric eye 62 which receives spot light leans only an include angle phi from the normal stood to the Bth page in the flat surface of the optical axis of a projector 61, and the normal stood to the Bth page to make, and is being fixed to the Bth page of another side. Moreover, a stage 63 can be attached in the inferior surface of tongue of the Bth page, and it can move now only in the direction of the z-axis by the driver (not shown). Moreover, as shown in drawing 25 (b), when spacing of the Ath page and the Bth page becomes the predetermined distance D, the mutual optical axis of the electric eye [the projector 61 fixed to the Ath page and] 62 fixed to the Bth page corresponds, and it is arranged so that the spot light from a projector 61 may be received by the electric eye 62. And it is the distance f from optical-system 60 point to the Bth page, i.e., the working distance of optical system 60, (distance whose focus suits) at this time. f=D-d -- (24)
It becomes.
[0120] Therefore, when it moved in the direction of the z-axis by the driver on the stage 63 and the distance of the Ath page and the Bth page is set to D in the condition of irradiating spot light from the projector 61, as shown in drawing 25 (c), a predetermined detecting signal is outputted from an electric eye 62. Thus, while according to the 6th example leaning only an include angle phi to the Ath page which meets in parallel, and the Bth page from the normal stood to those fields and fixing a projector 61 and an electric eye 62 to it Since the spot light from a projector 61 is received by the electric eye 62 and

a predetermined detecting signal is outputted, when the Bth page becomes the predetermined distance D with the Ath page by moving one Bth page in the direction of the z-axis by the driver, It is correctly [easily and] controllable to the working distance f of optical system 60. Moreover, the automatic focus of optical system 60 becomes possible by connecting the output and driver of an electric eye 62 and stopping migration automatically by the predetermined detecting signal.

[0121] In addition, in the 6th example of the above, although a driver moves only in the direction of the z-axis on a stage 63, it may attach the driver which moves also in the direction of a x axis, and the direction of the y-axis further. In this case, not only the automatic focus of optical system 60 but the alignment of the direction of a x axis optical system 60 and for [on the Bth page] observation and the direction of the y-axis becomes possible. Moreover, the migration by such driver may move not only a Bth page side but an Ath page side, or may move both both sides.

[0122] Moreover, in the 6th example of the above, although a projector 61 is fixed to the Ath page and the electric eye 62 is fixed to the Bth page, you may attach conversely mutually. Moreover, in the 6th example of the above, although the Ath page and the case where the Bth page had met in parallel were explained, also when not parallel, this invention can be applied. In this case, the distance of the predetermined point in not control but the Ath page of the distance D of the Ath page and the Bth page and the predetermined point in the Bth page will be controlled.

[0123] Moreover, as for the spot light irradiated from a projector 61, fully being extracted is desirable. the predetermined detecting signal outputted from the electric eye 62 shown in drawing 25 (b) -- width of face -- as long as -- it is because it becomes there is nothing and small, therefore the working distance f of optical system 60 will be controlled with high precision. Next, the positional controller which controls the relative location of two fields by the 7th example of this invention is explained using drawing 26 and drawing 27 .

[0124] Drawing 26 (a) and (b) are the schematic diagrams showing arrangement of 3 sets of light emitters and receivers when seeing the field of two controlled-system slack from a side face, respectively, and drawing 27 is the detection Fig. of the output signal of the electric eye of the positional controller. Although two fields of the Ath page and the Bth page set a certain spacing and have met as shown in drawing 26 (a), it is not necessarily parallel. And the 1st thru/or the 3rd projector 64, 65, and 66 which irradiates spot light are being fixed to the Ath page. The 1st projector 64 of them is attached at right angles to the Ath page, and the 2nd projector 65 leans only an include angle phi from the normal stood to the Ath page, and is attached, and from the normal stood to the Ath page, the 3rd projector 66 leans only an include angle psi, and is attached.

[0125] The 1st thru/or the 3rd electric eye 67, 68, and 69 which receives spot light are being faced and fixed to the Bth page of another side by the 1st thru/or the 3rd projector 64, 65, and 66, respectively. That is, the 1st electric eye 67 is attached at right angles to the Bth page, and the 2nd electric eye 68 leans only an include angle phi from the normal stood to the Bth page, and is attached, and from the normal stood to the Bth page, the 3rd electric eye 69 leans only an include angle psi, and is attached.

[0126] Moreover, the driver (not shown) which moves the location of the Ath page or the Bth page is prepared, and it is arranged so that the distance of the Ath page and the Bth page to make and the confrontation include angle of the Ath page and the Bth page to make can be changed by this driver. And the 1st thru/or the 3rd electric eye 67, 68, and 69 fixed to the 1st thru/or the 3rd projector 64, 65, and 66 fixed to the Ath page, and the Bth page As shown in drawing 16 (b), when the Bth page becomes parallel to the Ath page and spacing of the Ath page and the Bth page becomes the predetermined distance D, the optical axis of 3 sets of light emitters and receivers is in agreement, respectively. It is set up so that the 1st thru/or the spot light from the 3rd projector 64, 65, and 66 may be received by the 1st thru/or the 3rd electric eye 67, 68, and 69, respectively.

[0127] In therefore, the condition of irradiating spot light, from the 1st thru/or the 3rd projector 64, 65, and 66 When the Ath page or the Bth page is moved, the distance of the Ath page and the Bth page to make and the confrontation include angle of the Ath page and the Bth page to make were changed by the driver, the Bth page becomes parallel to the Ath page and spacing of the Ath page and the Bth page becomes the predetermined distance D As shown in drawing 27 , a predetermined detecting signal is

outputted from the 1st thru/or the 3rd electric eye 67, 68, and 69, respectively.
[0128] Thus, while attaching 3 sets of light emitters and receivers which become the Ath page which meets, and the Bth page from the 1st the 3rd projector 64, 65, and 66 and the 1st thru/or the 3rd electric eye 67, 68, and 69 in the direction different, respectively according to the 7th example By changing the distance of the Ath page and the Bth page to make, and the confrontation include angle of the Ath page and the Bth page to make by the driver When the Bth page becomes parallel to the Ath page and spacing of the Ath page and the Bth page becomes the predetermined distance D Since the 1st thru/or the spot light from the 3rd projector 64, 65, and 66 are received by the 1st thru/or the 3rd electric eye 67, 68, and 69 and a predetermined detecting signal is outputted, respectively, It is correctly [easily and] controllable so that the Bth page becomes the parallel location which kept the Ath page which meets, and the predetermined distance D. Therefore, the automatic control of the parallelism of the Ath page which kept the predetermined distance D, and the Bth page becomes possible by connecting the 1st thru/or each output and driver of the 3rd electric eye 67, 68, and 69.
[0129] In the 7th example of the above in addition, the 1st projector 64 at right angles to the Ath page The 2nd projector 65 leans only an include angle phi from the normal stood to the Ath page, and from the normal stood to the Ath page, the 3rd projector 66 leans only an include angle psi, and is fixed, respectively. Moreover, although these [1st] thru/or the 3rd projector 64, 65, and 66 are faced and the 1st thru/or the 3rd electric eye 67, 68, and 69 are being fixed to the Bth page For example, as shown in drawing 28 , this 3rd projector 70 is faced instead of the 3rd projector 66 in it using the 1st projector 64 and the 3rd projector 70 similarly fixed at right angles to the Ath page. The same effectiveness can be done so even if it fixes the 3rd electric eye 71 at right angles to the Bth page instead of the 3rd electric eye 69. It is because the relative location of the Ath page and the Bth page can be decided if the directions of at least 2 sets of light emitters and receivers differ among 3 sets of light emitters and receivers fixed to a different location.
[0130] Moreover, in the 7th example of the above, although the case where it controlled so that the Bth page becomes parallel to the Ath page was explained, the Ath page and not only when the Bth page becomes parallel but the thing controlled to become a predetermined confrontation include angle is possible by adjusting the installation location of the light emitter and receiver of the group fixed to the Ath page and the Bth page, and its direction.

[Translation done.]

* NOTICES *

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is a schematic diagram for explaining the lead pin test equipment of the brush which transmits a signal to the revolving shaft by the 1st example of this invention.
[Drawing 2] It is the block flow diagram which shows the circuitry which processes the output signal of the **** protection-from-light electric eye in the lead pin test equipment of drawing 1 .
[Drawing 3] It is the timing diagram of the output signal of the **** electric eye in the lead pin test equipment of drawing 1 .
[Drawing 4] It is the timing diagram of the output signal of the **** electric eye in the lead pin test equipment of drawing 1 .
[Drawing 5] It is the block flow diagram which shows the circuitry which processes the output signal of the **** electric eye in the 1st modification of the lead pin test equipment of drawing 1 .
[Drawing 6] It is the block flow diagram which shows the circuitry which processes the output signal of the **** electric eye in the 2nd modification of the lead pin test equipment of drawing 1 .
[Drawing 7] It is a schematic diagram for explaining the lead pin test equipment of the brush which transmits a signal to the revolving shaft by the 2nd example of this invention.
[Drawing 8] It is the block flow diagram which shows the circuitry which processes the output signal of the perpendicular electric eye in the lead pin test equipment of drawing 7 .
[Drawing 9] It is the timing diagram of the output signal of the perpendicular electric eye in the lead pin test equipment of drawing 7 .
[Drawing 10] When measuring disappearance pin several m of a lead pin, spot light is drawing for explaining that it is desirable to irradiate root Motobe of a lead pin.
[Drawing 11] It is a schematic diagram for explaining the lead pin test equipment of the IC package by the 3rd example of this invention.
[Drawing 12] It is the block flow diagram which shows the circuitry which processes the output signal of the perpendicular electric eye in the lead pin test equipment of drawing 11 , and a **** electric eye.
[Drawing 13] It is the timing diagram of the output signal of the perpendicular electric eye in the lead pin test equipment of drawing 11 , and a **** electric eye.
[Drawing 14] It is the expansion top view of the lead pin in the lead pin test equipment of drawing 11 .
[Drawing 15] It is drawing for explaining the principle of the light emitter and receiver of the lead pin test equipment by the 4th example of this invention.
[Drawing 16] It is a schematic diagram for explaining actuation of the light emitter and receiver used for the lead pin test equipment by the 4th example of this invention.
[Drawing 17] It is drawing for explaining the modification of the light emitter and receiver of drawing 15 .
[Drawing 18] It is drawing for explaining the modification of the light emitter and receiver of drawing 15 .
[Drawing 19] It is drawing for explaining the process in which the deflection of a lead pin is inspected using the light emitter and receiver of drawing 16 .

[Drawing 20] It is the principle explanatory view of the lead pin test equipment by the 5th example of this invention.
[Drawing 21] It is a schematic diagram for explaining the lead pin test equipment by the 5th example of this invention.
[Drawing 22] It is the block flow diagram which shows the circuitry which processes the output signal of the perpendicular electric eye in the lead pin test equipment of drawing 21 , and a **** electric eye.
[Drawing 23] It is a schematic diagram for explaining actuation of the both-way slide table in the lead pin test equipment of drawing 21 .
[Drawing 24] It is a schematic diagram for explaining migration of the IC package in the lead pin test equipment of drawing 21 .
[Drawing 25] It is a schematic diagram for explaining the positional controller by the 6th example of this invention.
[Drawing 26] It is a schematic diagram for explaining the positional controller by the 7th example of this invention.
[Drawing 27] It is the detection Fig. of the output signal of the electric eye of the positional controller of drawing 26 .
[Drawing 28] It is a schematic diagram for explaining the modification of the positional controller of drawing 26 .
[Drawing 29] It is a schematic diagram for explaining the conventional lead pin inspection approach.
[Drawing 30] It is a schematic diagram for explaining the conventional lead pin inspection approach.
[Drawing 31] It is a schematic diagram for explaining the conventional lead pin inspection approach.
[Drawing 32] It is a schematic diagram for explaining the conventional position control approach.
[Description of Notations]
10i i= -- 1, 2, --, n-- two or more lead pins
11 -- Brush
12 -- Transparence table
13 -- **** projector
14 -- **** electric eye
15 -- Time-of-day detector
16 -- The number counter of pins
17 -- ON / off time-of-day counter
18 -- OFF/ON time-of-day counter
19 -- The amount arithmetic circuit of height gaps
20 -- The number arithmetic circuit of disappearance pins
21 -- The amount store circuit of measurement
22 -- Defective judging circuit
23 -- Relative-speed-detector sensor
24 -- Distance detection sensor
25 -- It is a distance counter at the time of ON/OFF.
26 -- It is a distance counter at the time of OFF/ON.
27 -- Vertical illuminator
28 -- Perpendicular electric eye
29 -- The amount arithmetic circuit of location gaps
30i i= -- 1, 2, --, n-- two or more lead pins
31 -- IC package
32 -- Transparence table
33 -- The 1st vertical illuminator
34 -- **** projector
35 -- The 2nd vertical illuminator
36 -- 1st perpendicular electric eye
37 -- **** electric eye

38 -- 2nd perpendicular electric eye
39, 40, 41 -- Time-of-day detector
42 -- The number counter of pins
43 -- ON / off time-of-day counter
44 -- ON / off time-of-day counter
45 -- ON / off time-of-day counter
46 -- OFF/ON time-of-day counter
47 -- The amount arithmetic circuit of location gaps
48 -- The amount arithmetic circuit of height gaps
49 -- The amount arithmetic circuit of inclinations
50 -- The number arithmetic circuit of disappearance pins
51 -- Total quantity store circuit
52 -- Defective judging circuit
60 -- Optical system
61 -- Projector
62 -- Electric eye
63 -- Stage
64 -- The 1st projector
65 -- The 2nd projector
66 -- The 3rd projector
67 -- The 1st electric eye
68 -- The 2nd electric eye
69 -- The 3rd electric eye
70 -- The 3rd projector
71 -- The 3rd electric eye
80i i= -- 1, 2, --, n-- two or more lead pins
81 -- IC package
82 -- CCD camera
83 -- Displacement sensor
84 -- Photogenic organ
85 -- Electric eye
86 -- Laser length measuring machine
87 -- Reflective mirror
100 -- Projector
102 -- Lens
104 -- IC package
106 -- Lead pin
108 -- Transparence table
110 -- Electric eye
112 -- Electric eye
114 -- Electric eye
116 -- Electric eye
118 -- Electric eye
120 -- Support frame
122 -- Optical system
124 -- Spot
126 -- Lead pin
128 -- Foundation
130 -- Slide guide
132 -- Both-way slide table
134 -- Light-emitter-and-receiver unit

136 -- Light-emitter-and-receiver unit
138 -- Light-emitter-and-receiver unit
140 -- Light-emitter-and-receiver unit
142 -- Transfer robot
144 -- Gastrostyle
146 -- Arm
148 -- IC chuck
150 -- Supply stage
152 -- Work-piece susceptor
154 -- Ejection stage
156 -- Optical fiber
158 -- Detailed hole
160 -- Mask
162 -- Change machine
164 -- Index mark
166 -- 1st lead pin train
168 -- 2nd lead pin train
170 -- 3rd lead pin train
172 -- 4th lead pin train

[Translation done.]

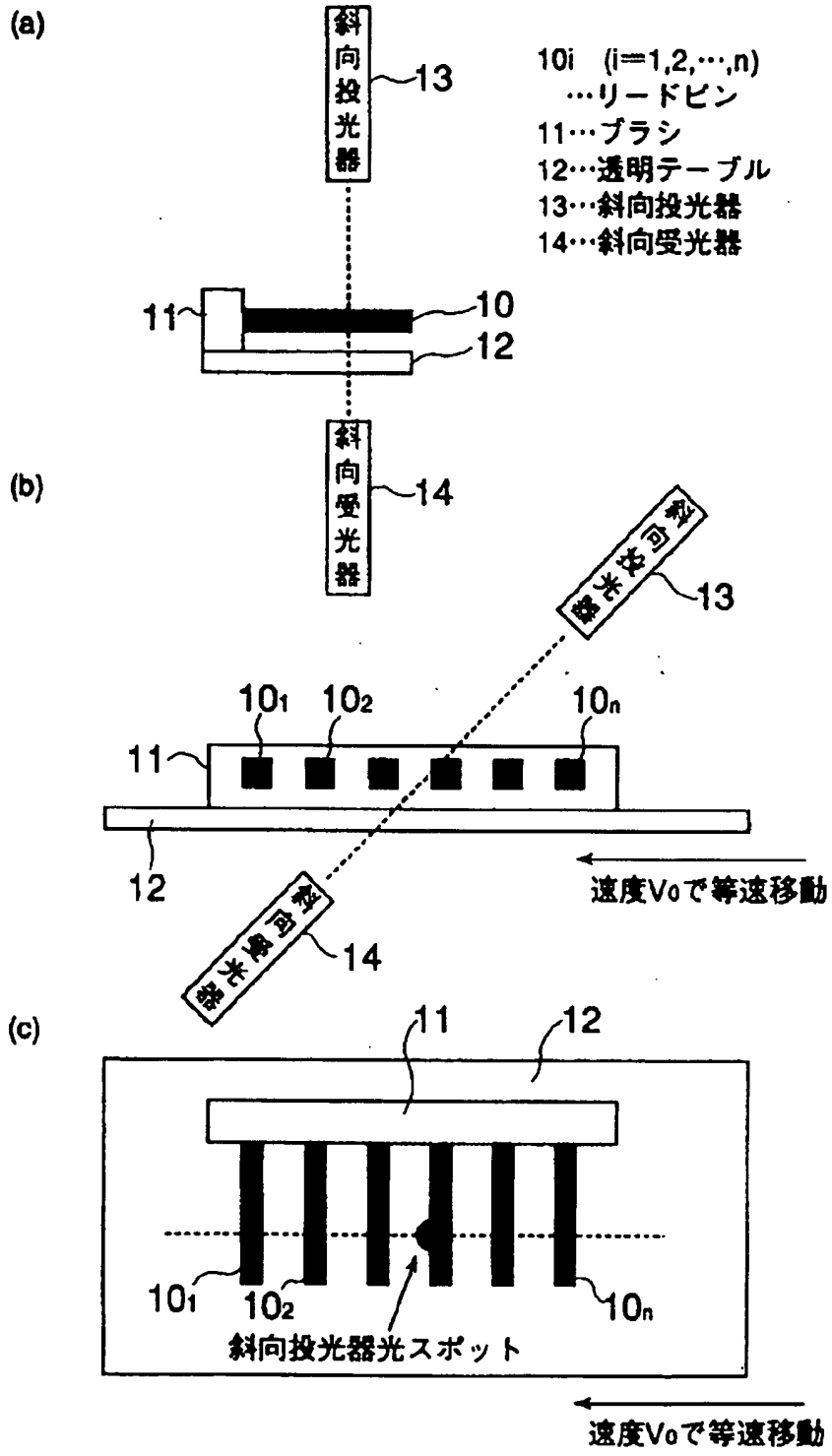
* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

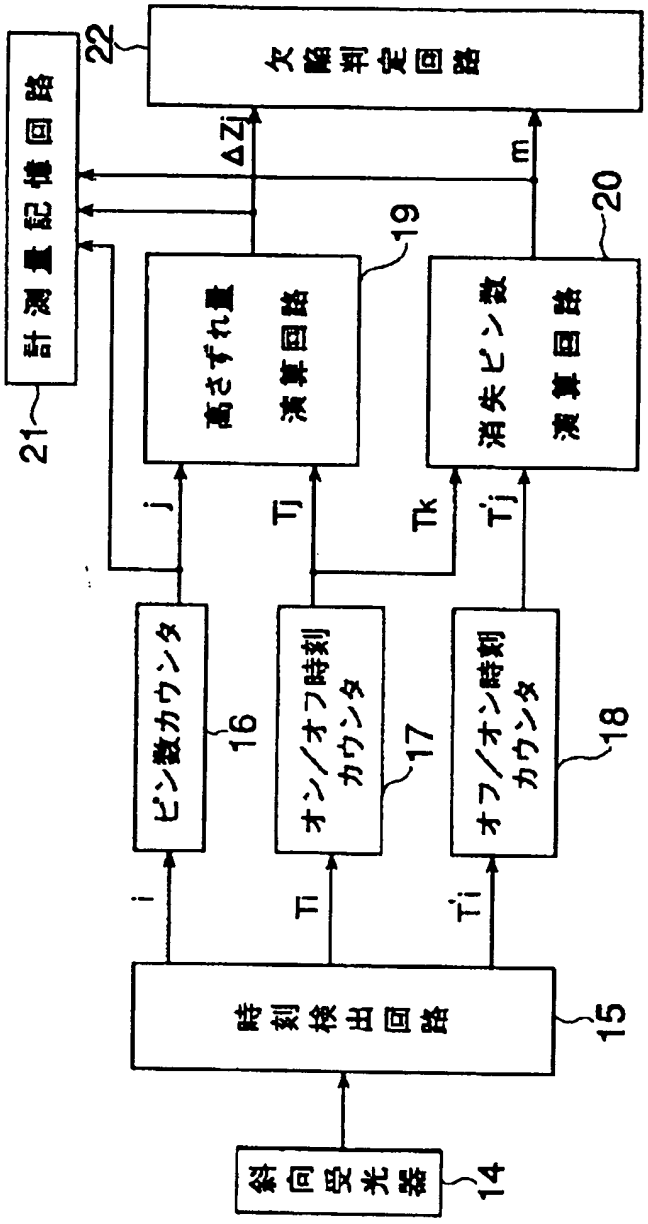
[Drawing 1]

本発明の第1の実施例による回転軸へ信号を伝達する
ブラシのリードピン検査装置を説明するための概略図



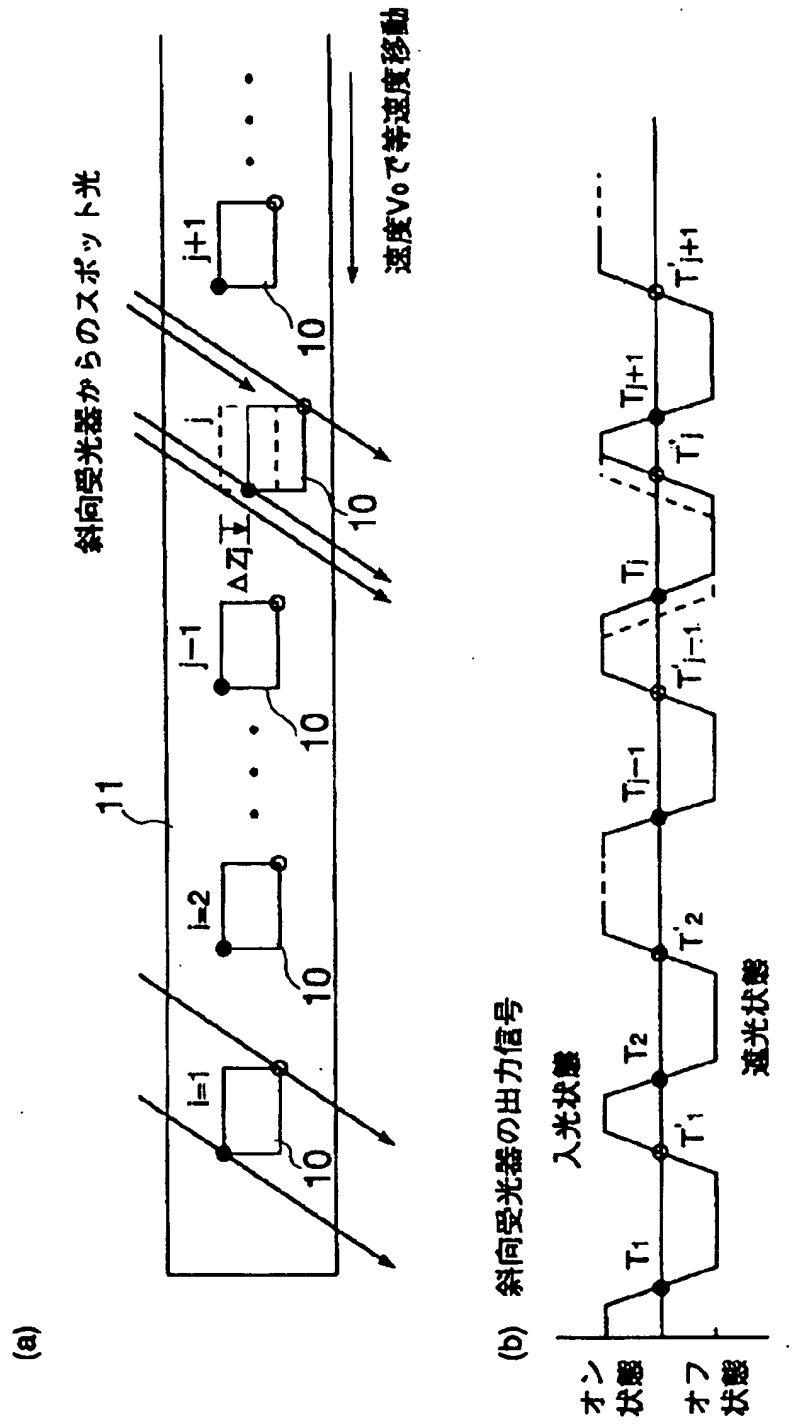
[Drawing 2]

図1のリードピン検査装置における斜向受光器の
出力信号を処理する回路構成を示すブロックダイアグラム



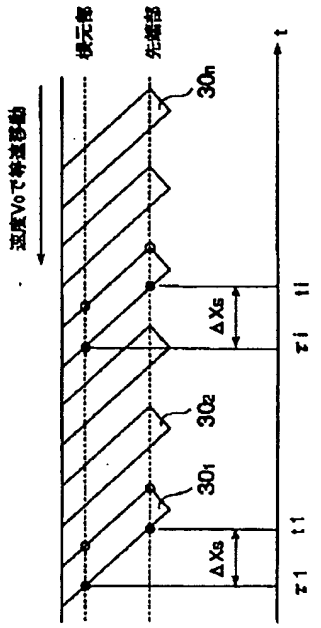
[Drawing 3]

図1のリードピン検査装置における
斜向受光器の出力信号のタイムチャート



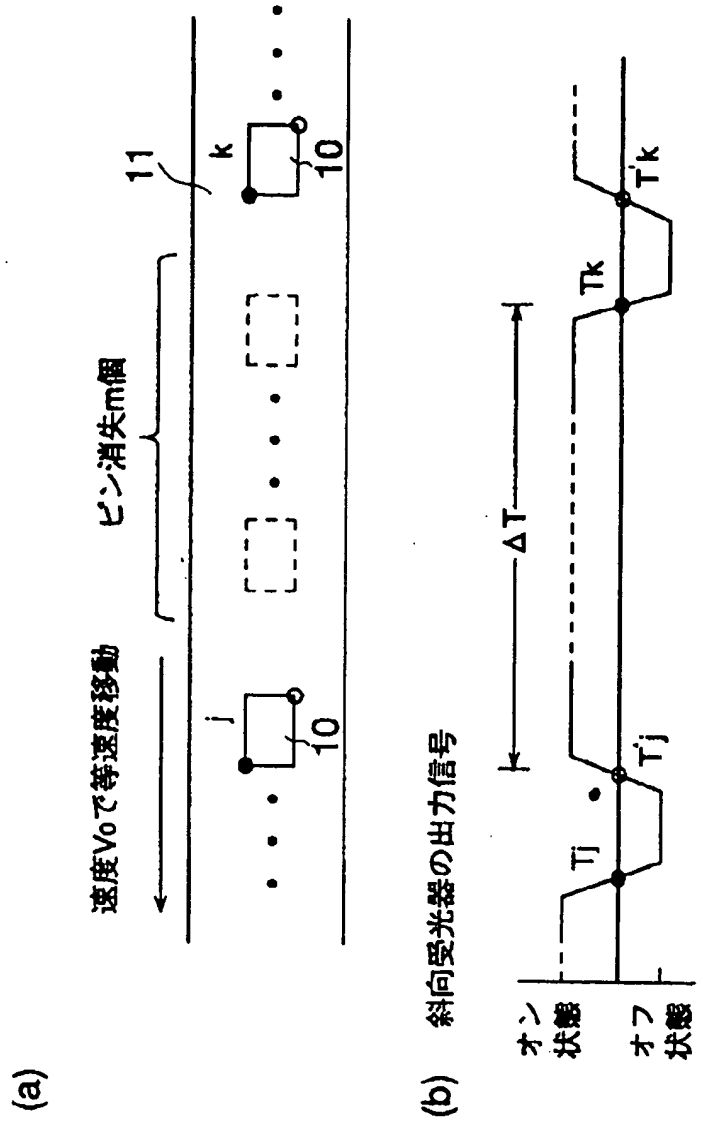
[Drawing 14]

図11のリードピン検査装置における
リードピンの拡大平面図



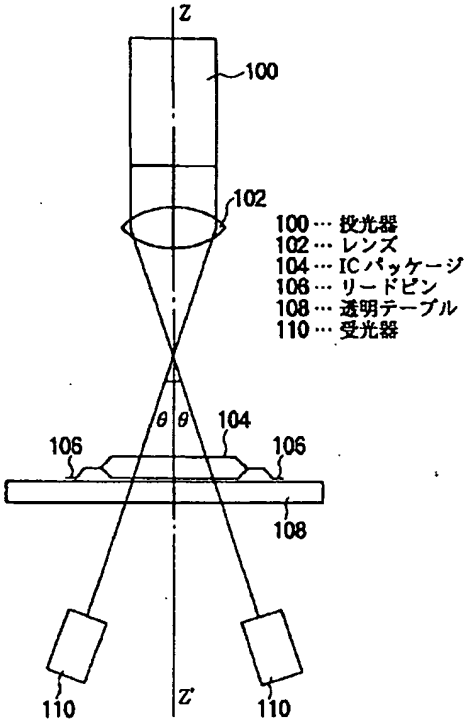
[Drawing 4]

図1のリードピン検査装置における
斜向受光器の出力信号のタイムチャート



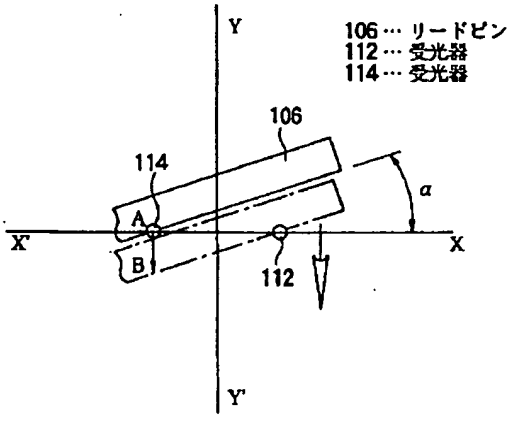
[Drawing 15]

本発明の第4の実施例によるリードピン検査装置の投受光器の原理を説明するための図



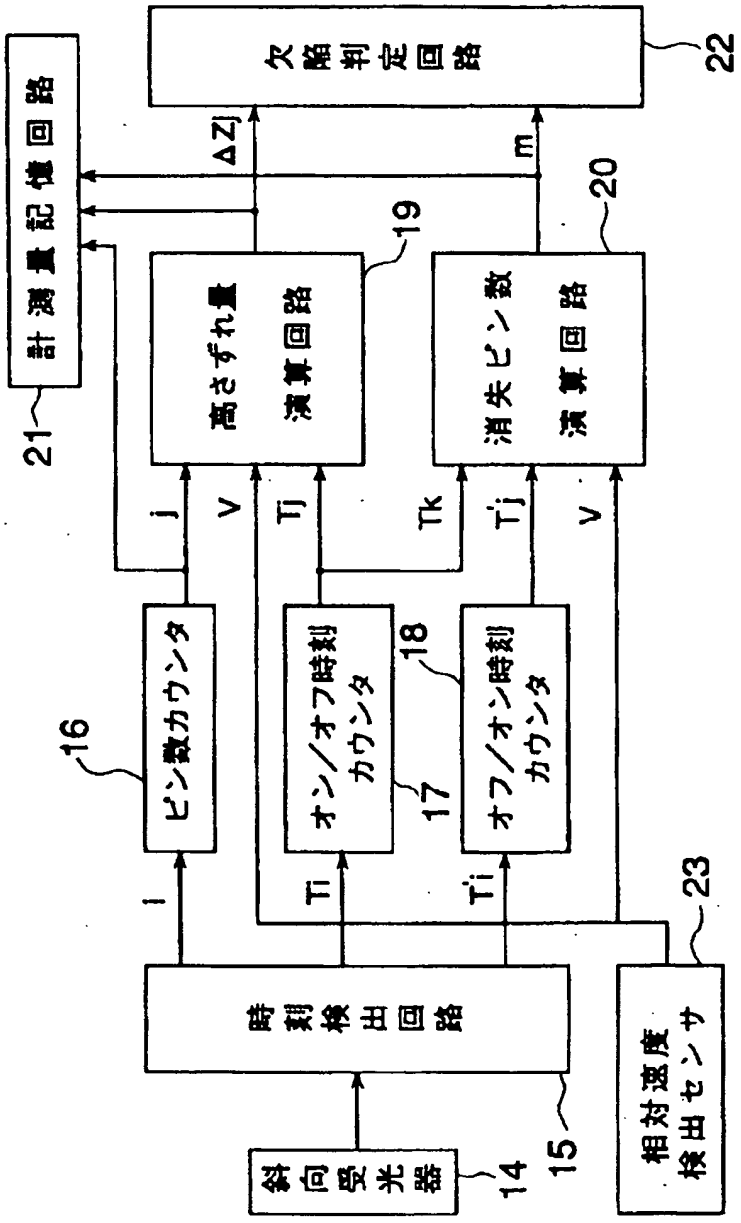
[Drawing 17]

図16の投受光器を用いてリードピンの曲がりを検査する過程を説明するための図



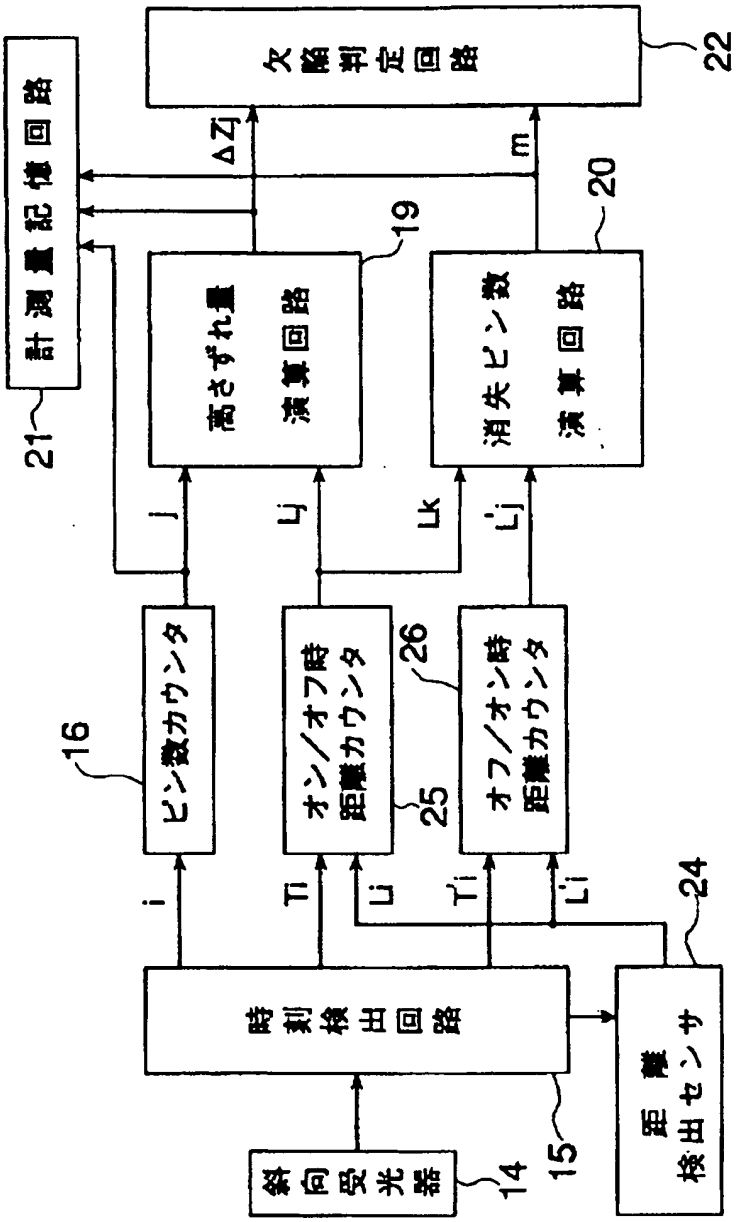
[Drawing 5]

図1のリードピン検査装置の第1の変形例における斜向受光器の出力信号を処理する回路構成を示すブロックダイアグラム



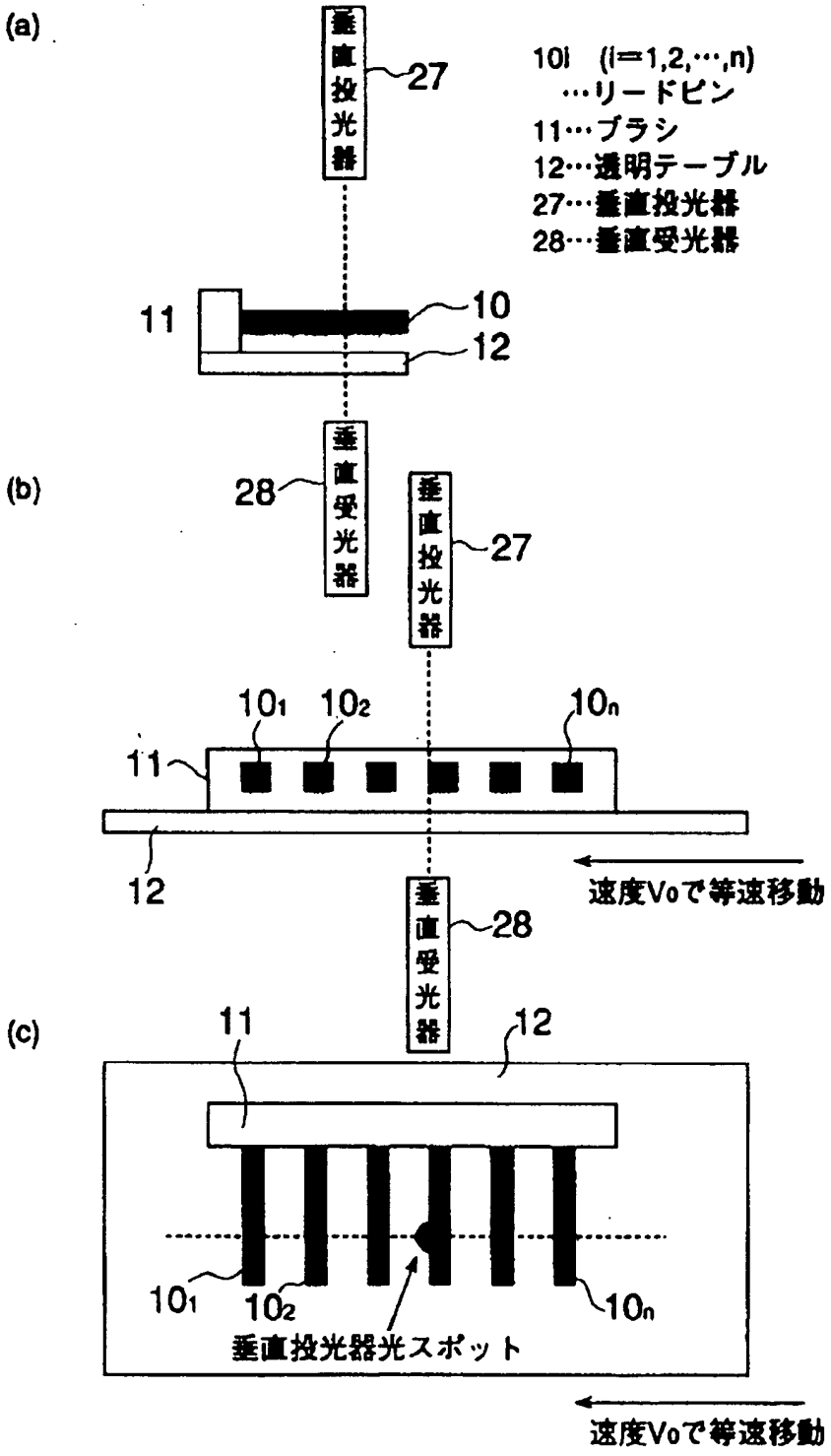
[Drawing 6]

図1のリードピン検査装置の第2の変形例における斜向受光器の出力信号を処理する回路構成を示すブロックダイアグラム



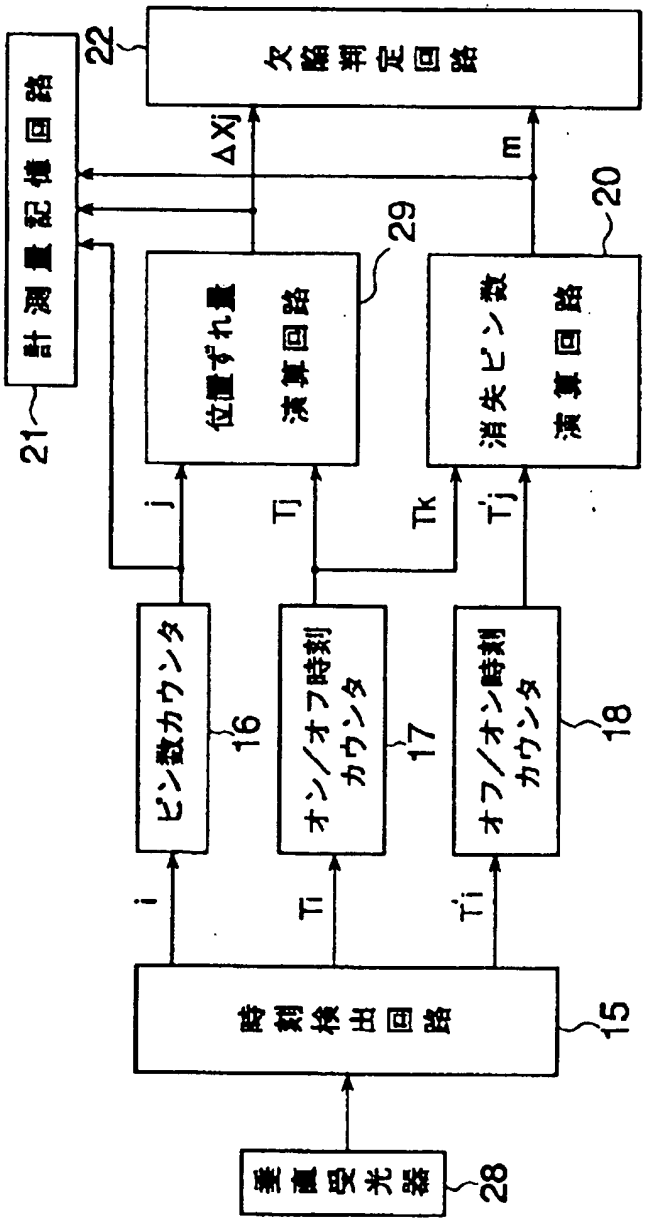
[Drawing 7]

本発明の第2の実施例による回転軸へ信号を伝達する
ブラシのリードピン検査装置を説明するための概略図



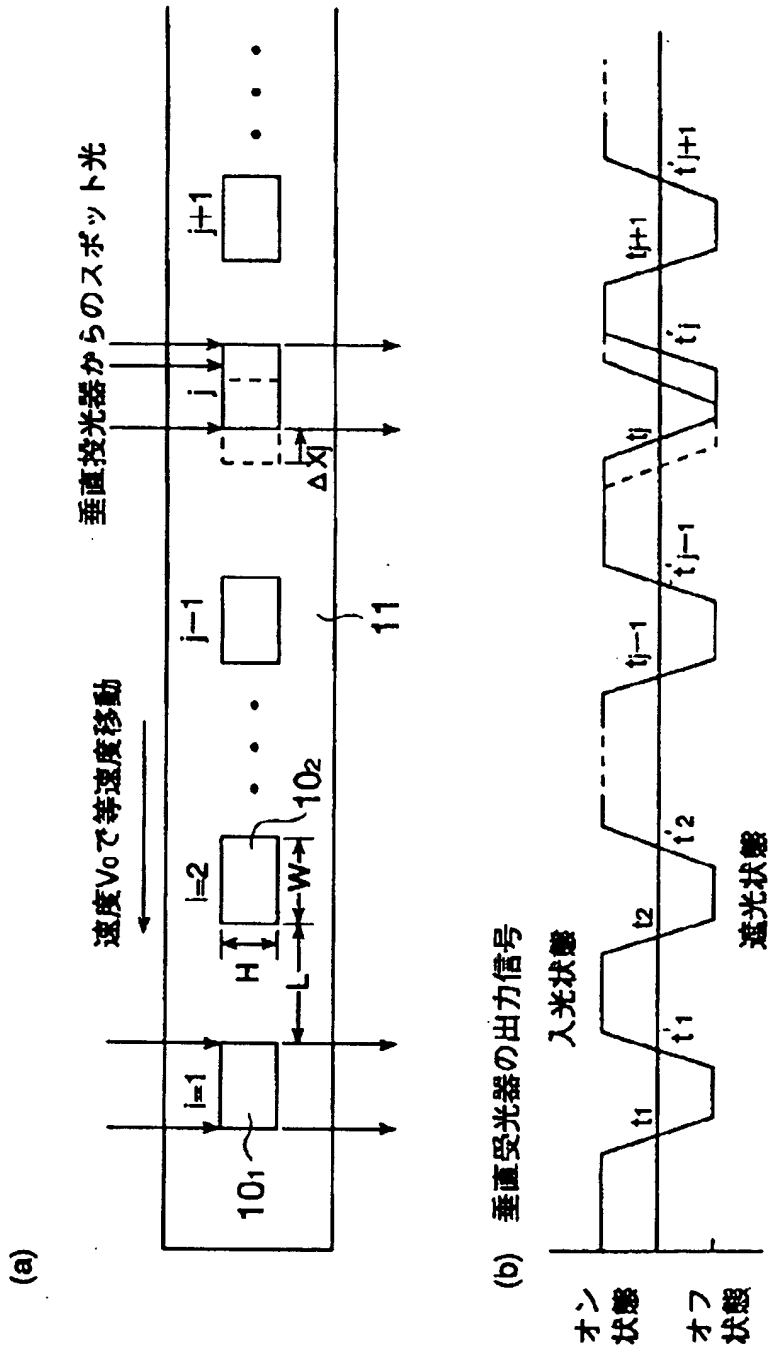
[Drawing 8]

図7のリードピン検査装置における垂直受光器の
出力信号を処理する回路構成を示すブロックダイアグラム



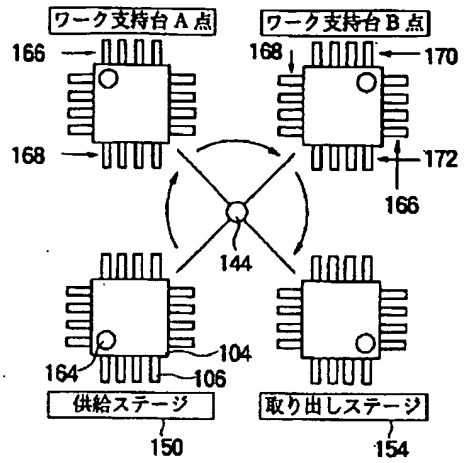
[Drawing 9]

図7のリードピン検査装置における
垂直受光器の出力信号のタイムチャート



[Drawing 24]

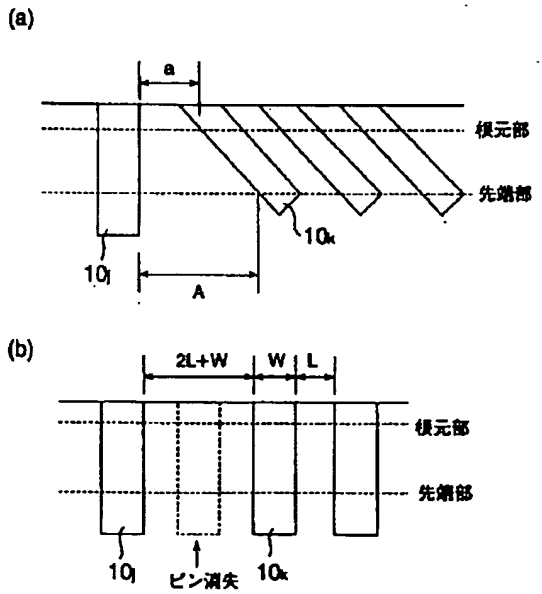
図21のリードピン検査装置における
ICパッケージの移動を説明するための概略図



104… ICパッケージ
106… リードピン
144… 軸柱
164… インデックスマーク
166… 第1のリードピン列
168… 第2のリードピン列
170… 第3のリードピン列
172… 第4のリードピン列

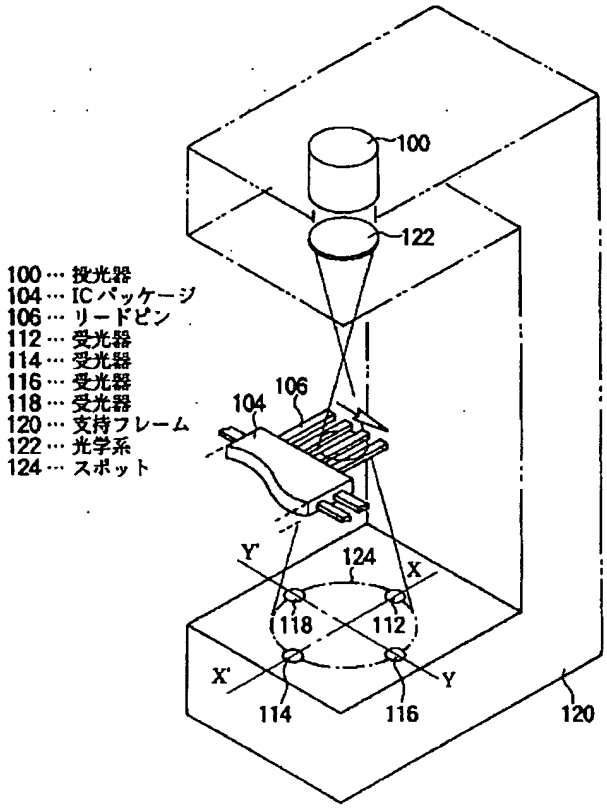
[Drawing 10]

消失ピン数の計測する場合にスポット光はリードピンの
根元部を照射することが望ましいことを説明するための
リードピンの拡大平面図



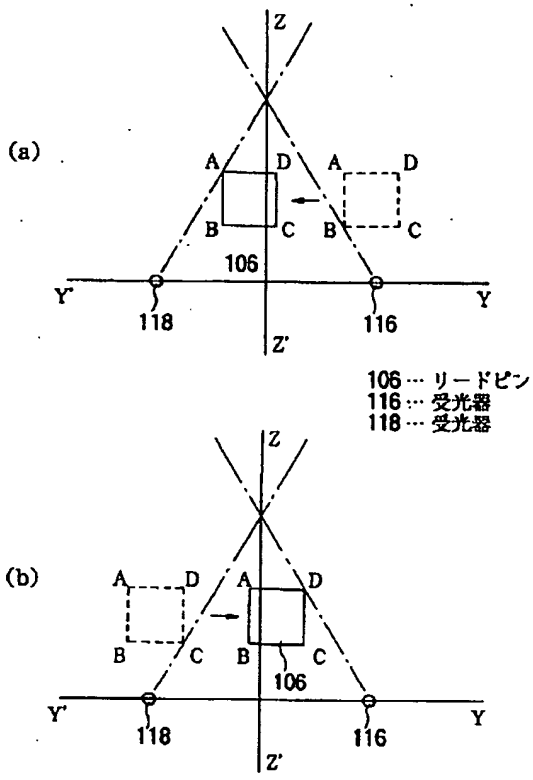
[Drawing 16]

本発明の第４の実施例によるリードピン検査装置に用いる
投受光器の動作を説明するための概略図



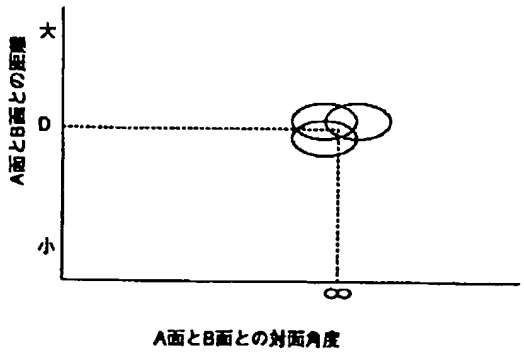
[Drawing 20]

本発明の第５の実施例によるリードピン検査装置の原理説明図



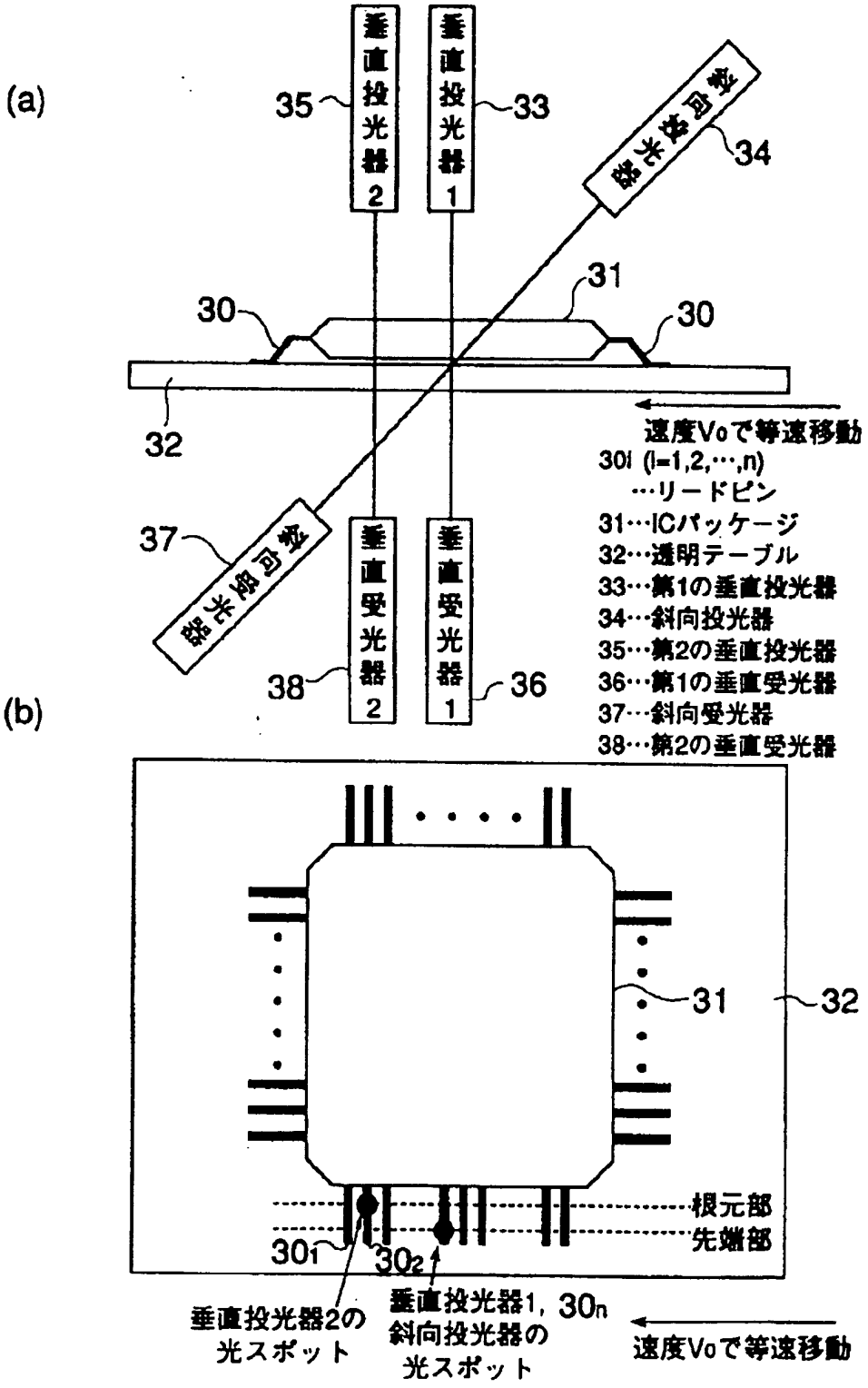
[Drawing 27]

図26の位置制御装置の受光器の出力信号の検出図



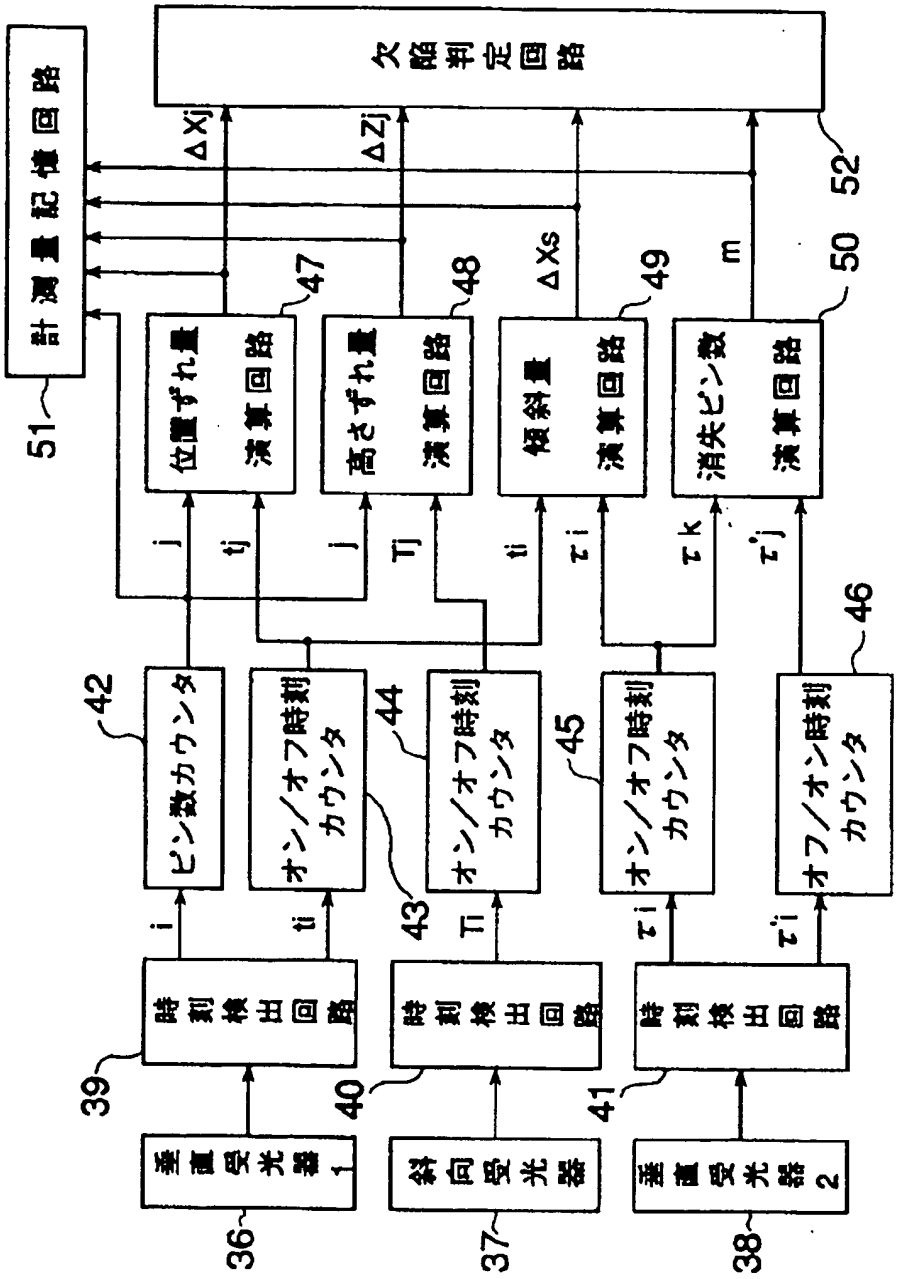
[Drawing 11]

本発明の第3の実施例によるICパッケージの
リードピン検査装置を説明するための概略図



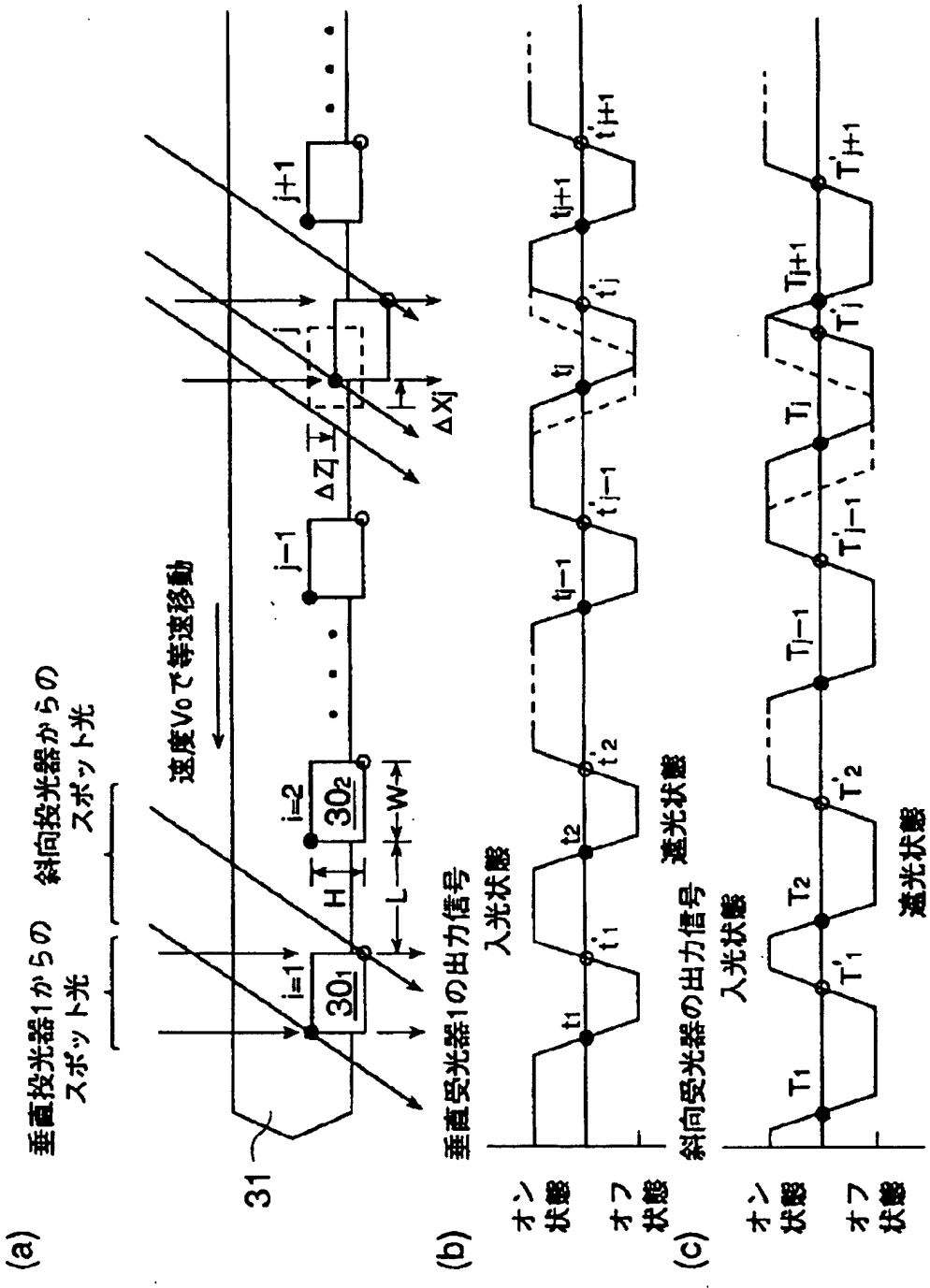
[Drawing 12]

図11のリードピン検査装置における垂直受光器及び斜向受光器の出力信号を処理する回路構成を示すブロックダイアグラム



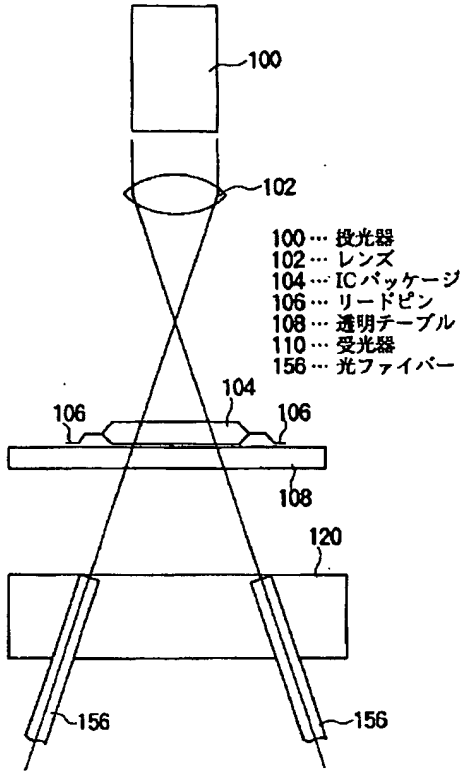
[Drawing 13]

図11のリードピン検査装置における垂直受光器及び斜向受光器の出力信号のタイムチャート



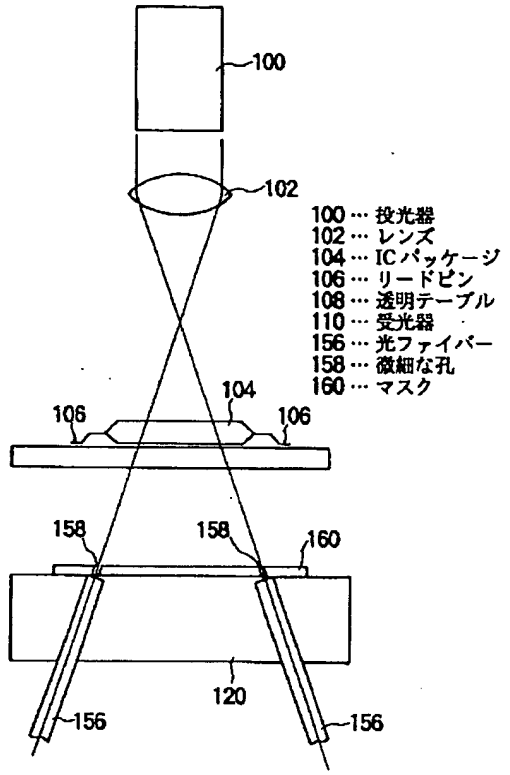
[Drawing 18]

図15の投受光器の変形例を説明するための図



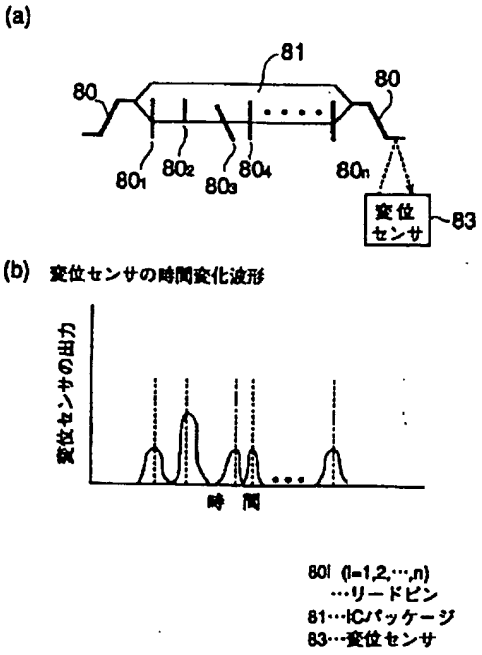
[Drawing 19]

図15の投受光器の変形例を説明するための図



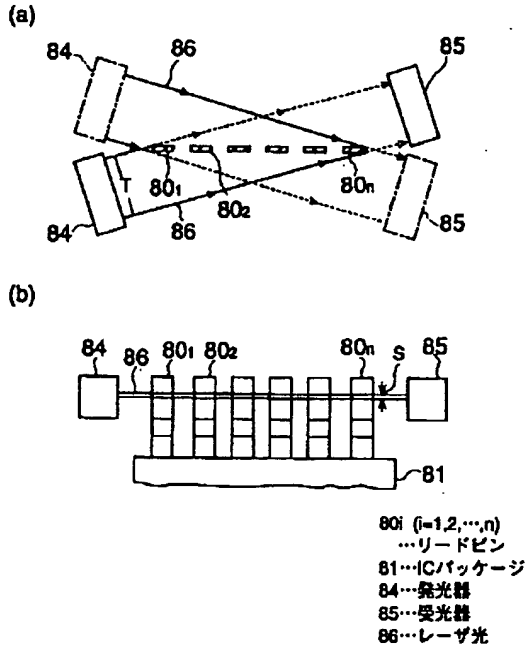
[Drawing 30]

従来のリードピン検査方法を説明するための概略図

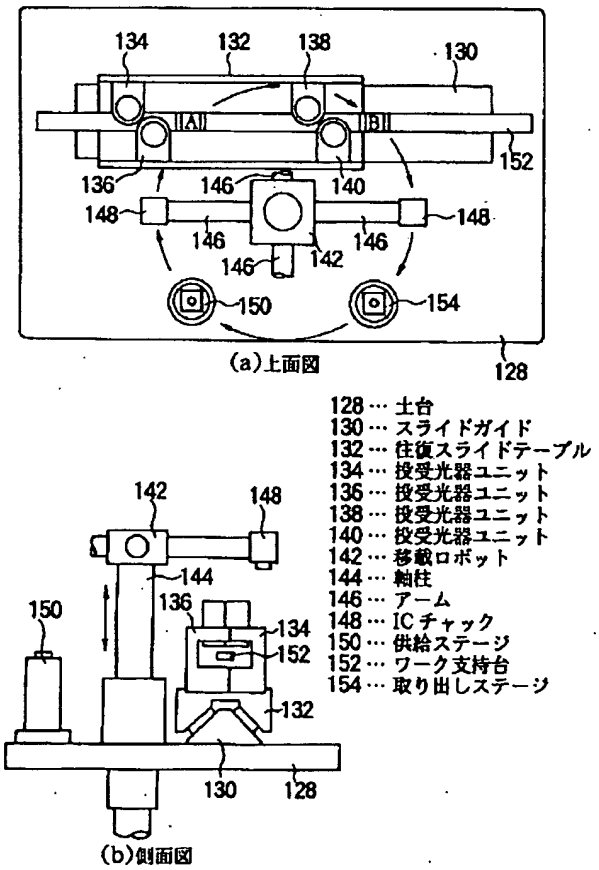


[Drawing 31]

従来のリードピン検査方法を説明するための概略図

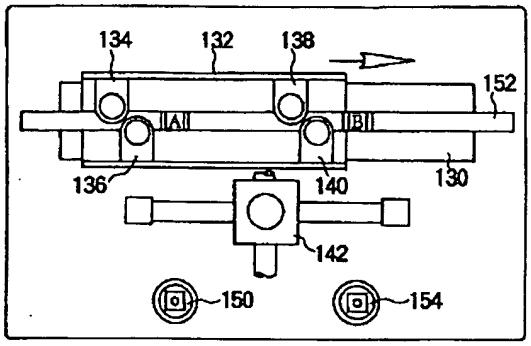


[Drawing 21]
本発明の第５の実施例によるリードピン検査装置を説明するための概略図

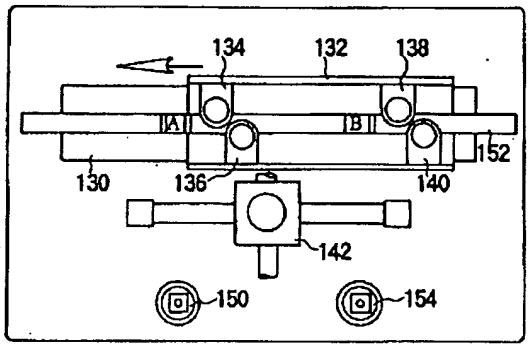


[Drawing 23]

図21のリードピン検査装置における
往復スライドテーブルの動作を説明するための概略図



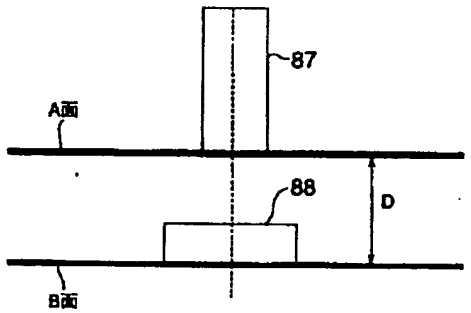
(a)



(b)

[Drawing 32]

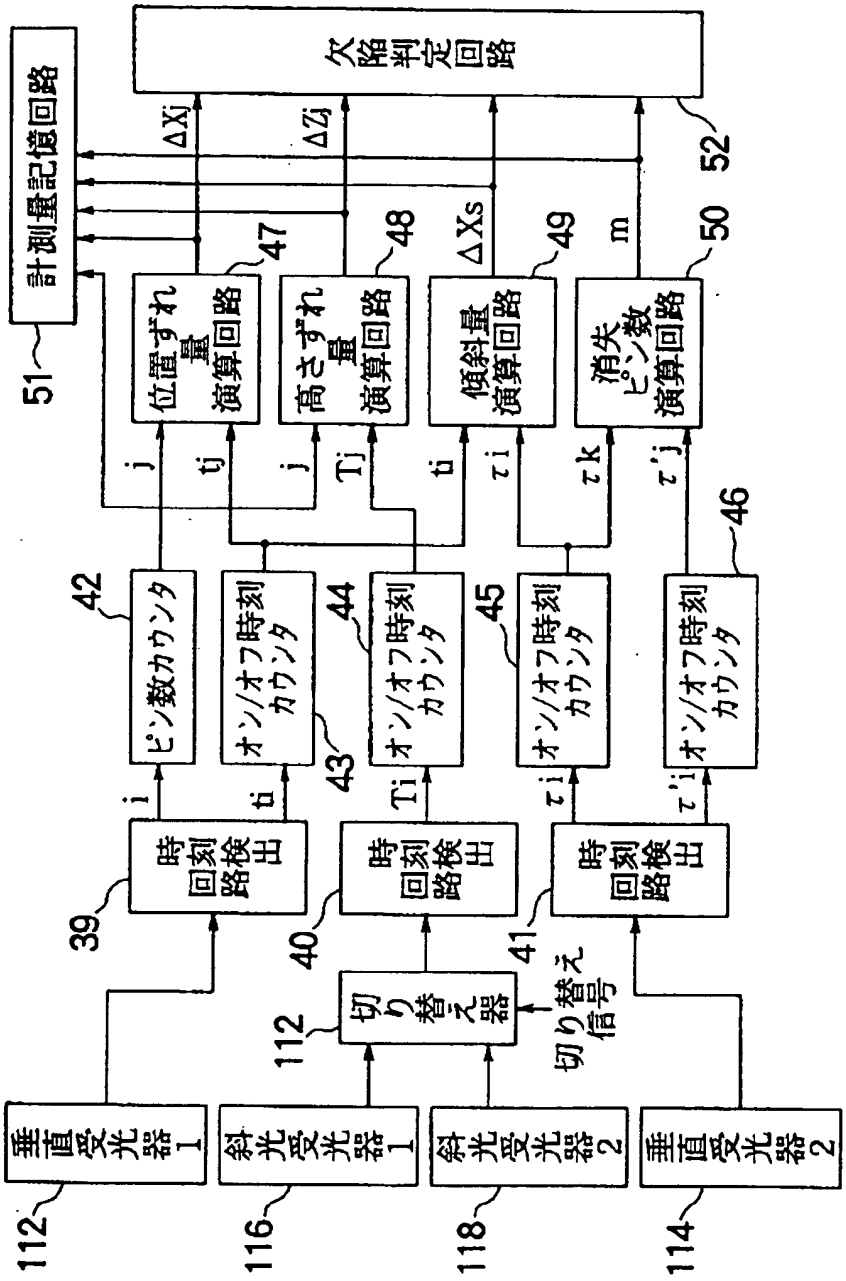
従来の位置制御方法を説明するための概略図



87…レーザ測長器
88…反射ミラー

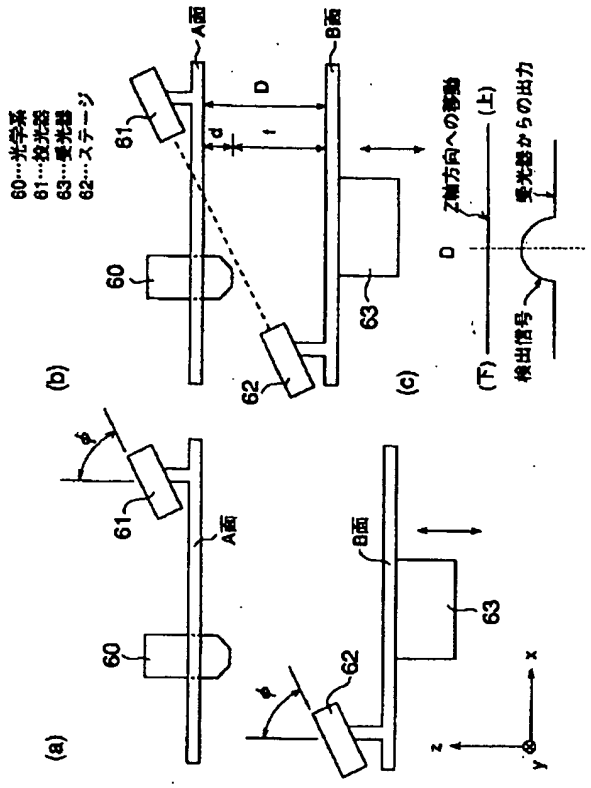
[Drawing 22]

図21のリードピン検査装置における垂直受光器及び斜向受光器の出力信号を処理する回路構成を示すブロックダイアグラム



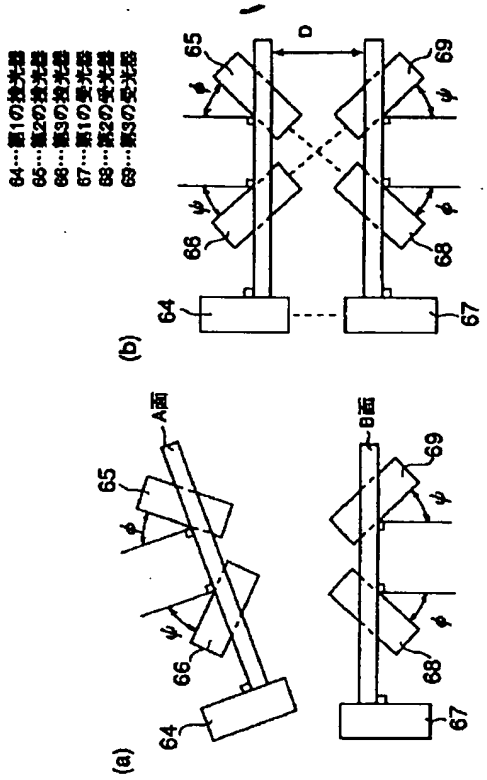
[Drawing 25]

本発明の第6の実施例による
位置制御装置を説明するための概略図



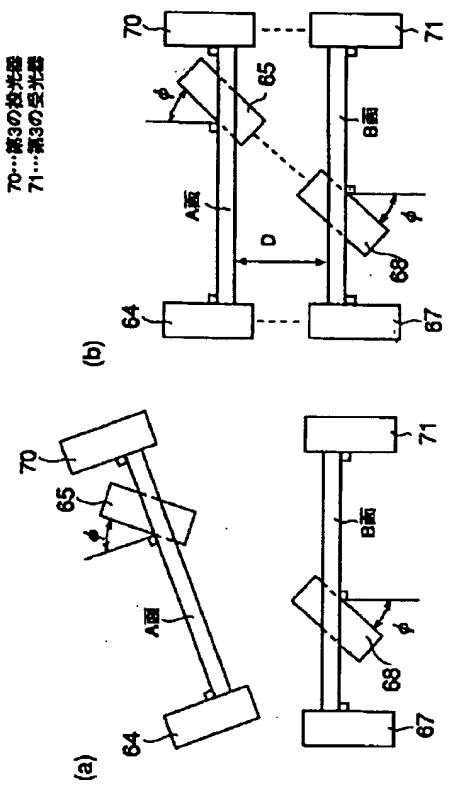
[Drawing 26]

本発明の第7の実施例による
位置制御装置を説明するための概略図



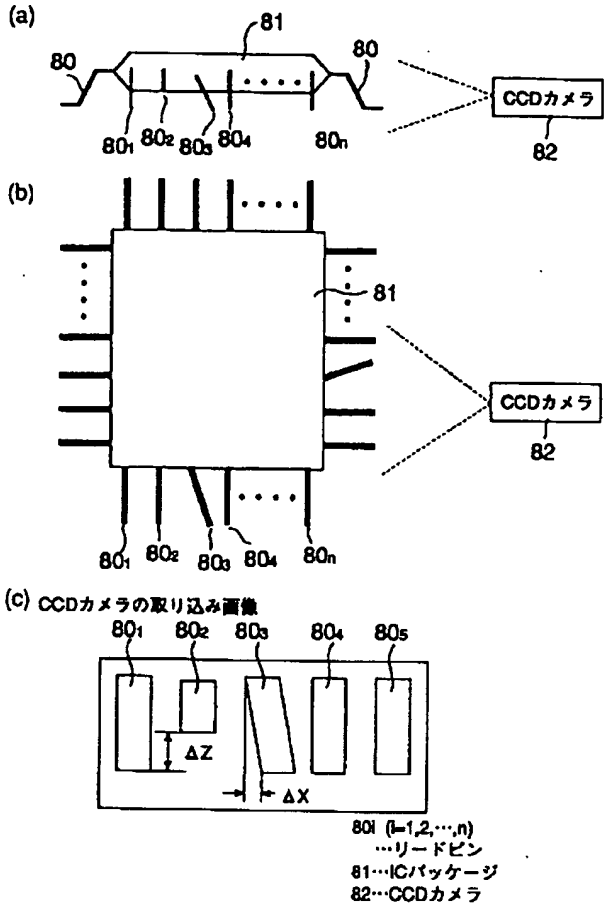
[Drawing 28]

図26の位置制御装置の変形例を説明するための概略図



[Drawing 29]

従来のリードピン検査方法を説明するための概略図



[Translation done.]